User's Manual

ADMAG AE

Model AE14
Magnetic Flow Converter

IM 1E7C1-E

YOKOGAWA
Yokogawa Electric Corporation

IM 1E7C1-E
10th Edition

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1. INTRODUCTION

This instrument has been already adjusted correctly at the factory before shipment.
To ensure correct use of the instrument, please read this manual throughly and fully understand how to operate the instrument before operating it.

• Regarding This Manual

- This manual should be passed on to the end user.
- Before use, read this manual throughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors are found, please inform YOKOGAWA.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owning to any defects in the product which were not predictable, or for any indirect damages.

• Safety Precautions

*The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. YOKOGAWA Electric Corporation assumes no liability for the customer's failure to comply with these requirements. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.

The following safety symbol marks are used in this manual and instrument ;

A **WARNING** sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

A **CAUTION** sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

A **IMPORTANT** sign denotes an attention to avoid leading to damage to instrument or system failure.

A **NOTE** sign denotes a information for essential understanding of the operation and features.

⏚ Protective grounding terminal.

⏚ Function grounding terminal. This terminal should not be used as a "Protective grounding terminal".

~ Alternating current.

⎓ Direct current.

• Warranty

* The guaranteed term of this instrument is described in the quotation. We repair the damages that occurred during the guaranteed term for free.
* Please contact with our sales office when this instrument is damaged.
* If the instrument has trouble, please inform us model code, serial number, and concrete substances or situations. It is preferable to be attached a outline or data.
* We decide after the examination if free repair is available or not.
* Please consent to the followings for causes of damages that are not available as free repair, even if it occured during the guaranteed term.
  A: Unsuitable or insufficient maintenance by the customer.
  B: The handling, using, or storage that ignore the design and specifications of the instrument.
  C: Unsuitable location that ignore the description in this manual.
  D: Remaking or repair by a person except whom we entrust.
  E: Unsuitable removing after delivered.
  F: A natural disaster (ex. a fire, earthquake, storm and flood, thunderbolt) and external causes.

For the safety using;

WARNING

- The Magnetic Flowmeter is a heavy instrument. Please give attention to prevent that persons are injured by carrying or installing. It is preferable for carrying the instrument to use a cart and be done by two or more persons.
- In wiring, please comfirm voltages between the power supply and the instrument before connecting the power cables. And also, please comfirm that the cables are not powered before connecting.
- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
- In case of Hazardous duty type instrument, further requirements and differences are described in Chapter 12 "HAZARDOUS DUTY TYPE INSTRUMENT". The description in Chapter 12 is prior to other description in this instruction manual.

2. HANDLING PRECAUTIONS

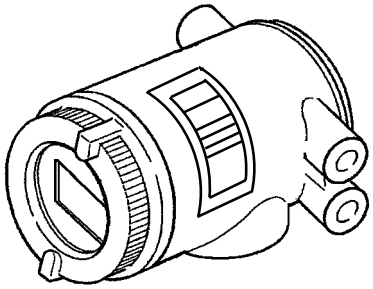
This instrument has been already tested throughly at the factory.
When the instrument is delivered, check its appearance to confirm that no damage occurred during trasnportation.

Read this chapter thoroughly at first. If you have any problems or questions, contact YOKOGAWA sales office.

2.1 Checking Model and Specifications

Model and specifications can be found on the data plate located on the flow converter. Check that the specifications in the purchase order match the specifications given in the Model and Specification Codes in Chapter 9.

Please let us know Model and Serial number when contacting a YOKOGAWA sales office.



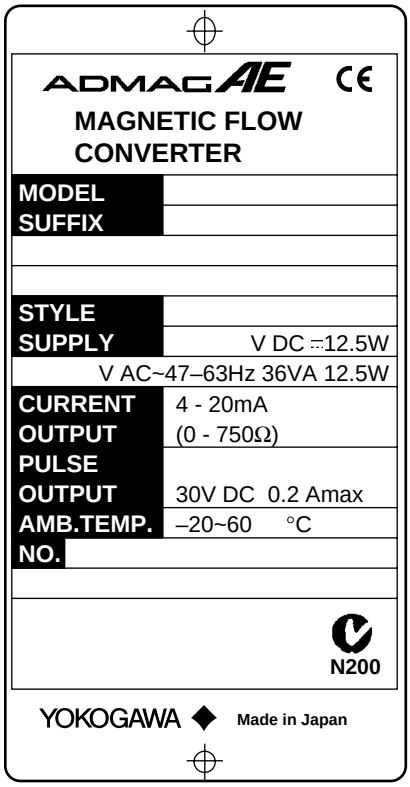


Figure 2.1 Data Plate

2.2 Accessories

When the instrument is delivered, make sure that the following accessories are in the package.

- Fuse (250 V, 2A time lag) (the spare fuse is taped to the converter) (1-piece)
- Data sheet (1-sheet)
- Mounting hardware
- Plug (for DC power supply only) (1-piece)
- Unit labels
- Hexagonal wrench (special screw for converter : in case of Hazardous duty type) (1-piece)

2.3 Storage Precautions

In case the instrument is expected to be stored over a long term, please give attention to the followings :

(1) The instrument should be stored in its original packing condition.
(2) The storage location should be selected according to the following conditions :
- The location where it is not exposed to rain or water.
- The location where there is few vibration or shock.
- Temperature and humidity should be :
  Temperature : -20 to 60°C (-4 to 140°F)
  Humidity : 5 to 80% RH (Avoid vapor condensation)
  Preferable ambient temperature and humidity are 25°C (75°F) and about 65%RH.

2.4 Installation Location Precautions

Select the installation location considering the following items to ensure long term stable operation of the flowmeter.

(1) Ambient Temperature

Avoid to install the instrument at the location where temperature chages continuously. If the location receives radiant heat from the plant, provide heat insulation or improve ventilation.

(2) Atmospheric Condition

Avoid to install the instrument in an corrosive atmosphere. In case of installing in the corrosive atmosphere, please keep ventilating sufficiently and prevent rain from entering the conduit.

(3) Vibration, Shock

Avoid to install the instrument at the location where there is heavy vibration or shock.

3. INSTALLATION

WARNING This instrument must be installed by expert engineer or skilled personnel. The procedures described in this chapter are not permitted for operators.

3.1 Installing the Magnetic Flow Converter

A signal cable (AM011) is used between the remote type flow tube and the converter. The maximum signal cable length is 30m (98ft).
The converter is mounted on a 2 inch (60.5mm outer dia.) vertical or horizontal pipe. See Figure 3.1.

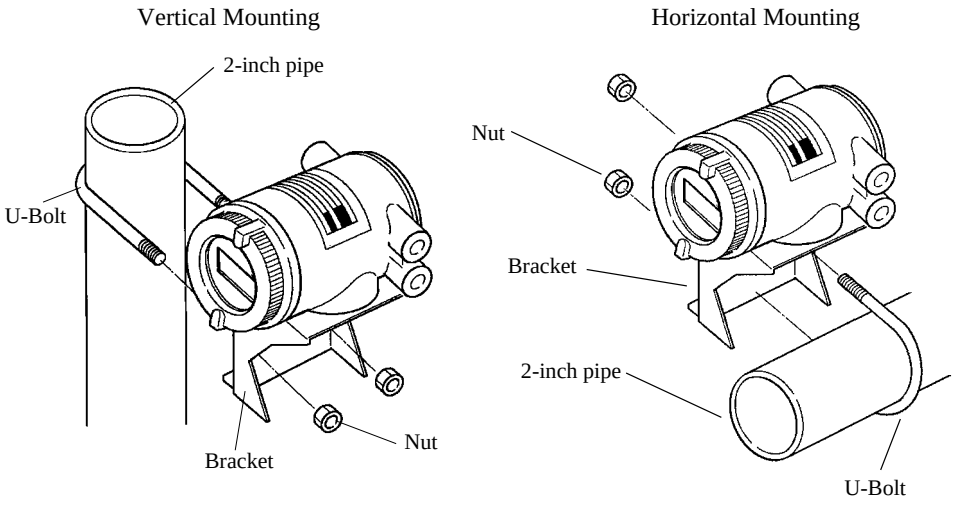
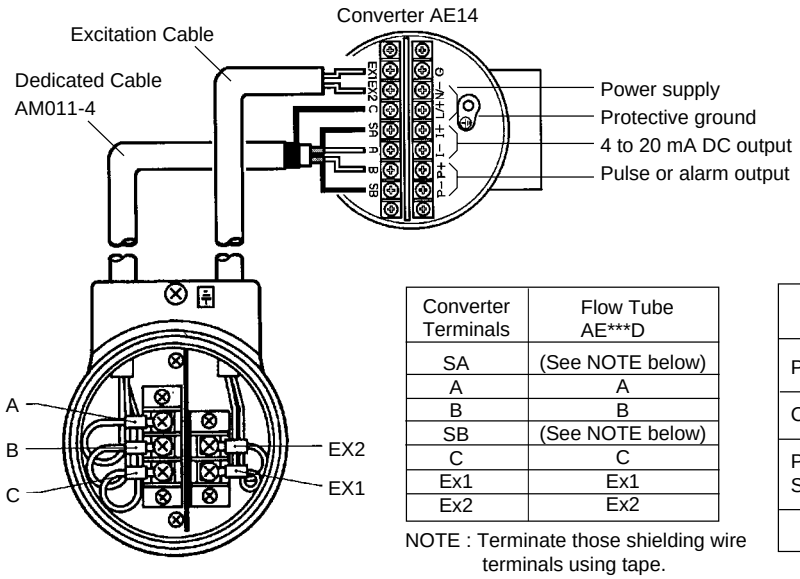


Figure 3.1 Magnetic Flow Converter Installation

3.2 Wiring Precautions

Connect outer cables of the converter to the terminals inside the converter case.

When the cover is removed, the connecting terminals appear. Connect the cables to the terminals according to Figure 3.2.1.



Converter Terminals	Flow Tube AE***D
SA	(See NOTE below)
A	A
B	B
SB	(See NOTE below)
C	C
Ex1	Ex1
Ex2	Ex2

NOTE : Terminate those shielding wire terminals using tape.

Converter Terminals		External Instruments
PLS/ALM	P+ P-	Pulse, alarm or status output
CUROUT	I+ I-	Current output 4 to 20mA DC
POWER SUPPLY	L/+ N/-	Power supply
	⏚	Protective Grounding

Figure 3.2.1 Wiring

3.2.1 Protective Grounding

CAUTION

- Be sure to connect protective grounding of ADMAG AE with cable of 2mm^2 or larger cross section in order to avoid the electrical shock to the operators and maintenance engineers and prevent the influence of external noise. Connect the grounding to the ⏚ mark (100Ω or less).
- Confirm all connections before power is turned on when the wiring has finished completely. Wrong wiring give damages to functions of the flowmeter.
- Give attention to avoid the cable is bended excessively.

3.2.2 General Precautions

Please give attention to the following in wiring.

CAUTION

- Please do not connect cables outdoors in case of rain to prevent damages from dew formation and to keep insulation inside the terminal box of the flowmeter.
- The all cable ends are to be provided with round crimp-on terminal.
- Power cable and output signal cables must be routed in separate steel conduit tubes.
- When waterproof glands or union equipped waterproof glands are used, the glands must be properly tightened to keep the box watertight.
- Please install a external switch or circuit breaker as a means of power off (capacitance:15A, conform to IEC 947-1 and IEC 947-3). The preferable location is either near the instrument or other places to easy operation. Furthermore, please indicate "power off equipment" on the those external switch or circuit breaker.

CAUTION

- Please be sure to fully tighten the terminal box cover before the power is turned on.
- Please be sure to turn off the power before opening the terminal box cover.
- In case of DC power supply, a plug is attached. When 4-core cable is used, please put that plug into unused electrical connection port.

3.2.3 Cable Types

(1) Dedicated Signal Cables (Between Flow Tube and Converter)

Dedicated signal cable (Model AM011)

The flow signal is transmitted via this dedicated cable. The cable is constructed with double shielding over the two conductors, and used heat-resistant vinyl as the outer jacket material. Heat-resistance of the cable is 80˚C. Finished diameter is 10.5 mm(0.413”)

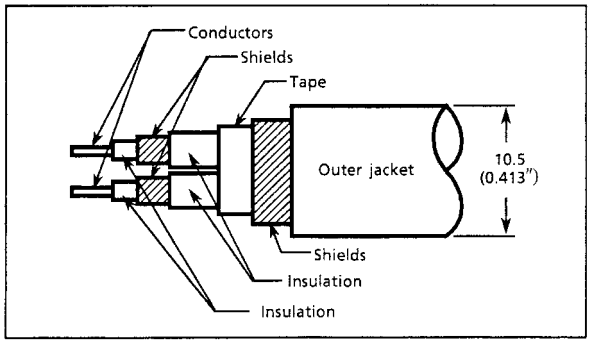


Figure 3.2.2 Dedicated Signal Cable AM011

IMPORTANT

The dedicated signal cable can be extended up to a distance of 30 m (98feet). If the cable is longer than required, cut off any extra length, rather coiling it up, and terminate the conductors as shown in Figure 3.2.3. Avoid using intermediate terminal boards to extend the cable length, or this will interrupt the shielding.

CAUTION

Since A, B, SA, SB, and C all operate at different electrical potentials, securely insulate them from each other so they do not touch.
The shields must not be allowed to touch each other or to touch the case.
Cover each shield with vinyl tube or wrap in vinyl tape.

NOTE

Conductors A and B carry the signal from the electrodes, and C is at the potentials of the liquid it self (signal common) . Shields SA and SB are kept at the same potentials as the individual electrodes (these are actively driven shields). This is done to reduce the effect of the distributed capacitance of the cable at long cable length. Note that, since the signals from the individual electrodes are impedance- converted inside the converter, errors will result if they come in contact with any other component. Great care must be taken in the cable end treatment.

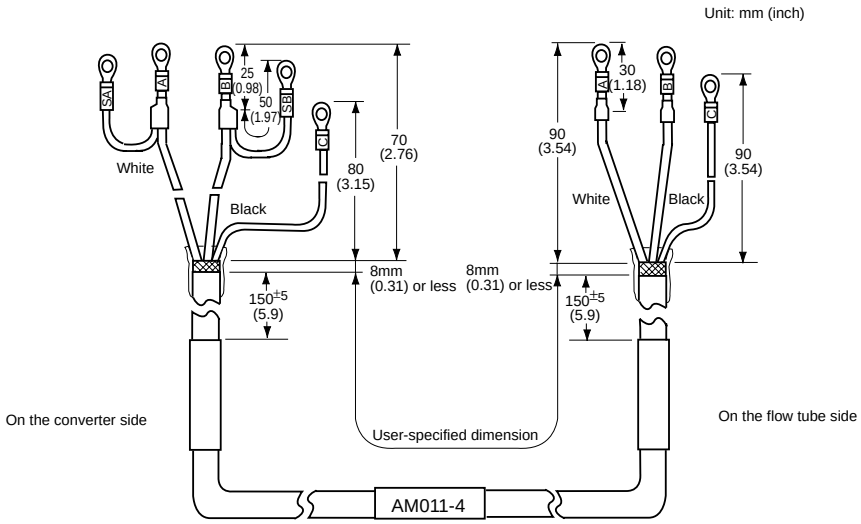


Figure 3.2.3 Dedicated Signal Cable end Treatment

(2) **Power, Excitation or Output to External Instrument**

Power Cable

- Crimp-on Terminal
- Green/Yellow covered conductors shall be used only for connection to PROTECTIVE CONDUCTOR TERMINALS.
- Conform to IEC227 or IEC245 or equivalent national authorization

Excitation or Output Cable

- Please use Polyvinyl chloride insulated and sheathed control cables(JIS C3401) or Polyvinyl chloride insulated and sheathed portable power cables(JIS C3312) or equivalents.

Outer Diameter

- 6.5 to 12mm in diameter (10.5 or 11.5mm for waterproof gland /ECG, /ECU)

Nominal Cross Section

- Single wire ; 0.5 to 2.5mm^2, Stranded wire ; 0.5 to 2.5mm^2

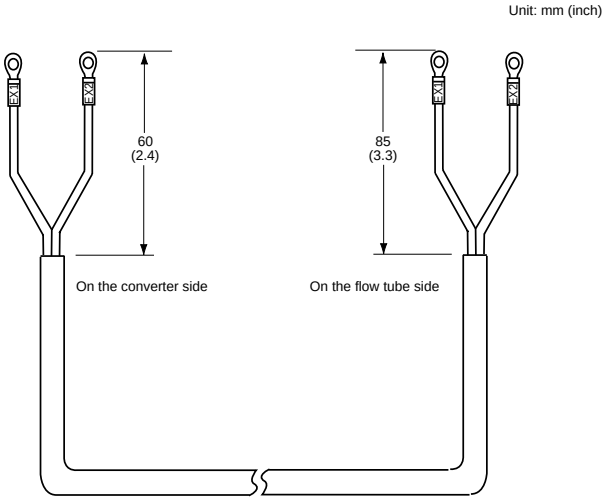


Figure 3.2.4 End Treatment of Excitation Cable

3.2.4 DC Connections

(1) Connecting Power Supply

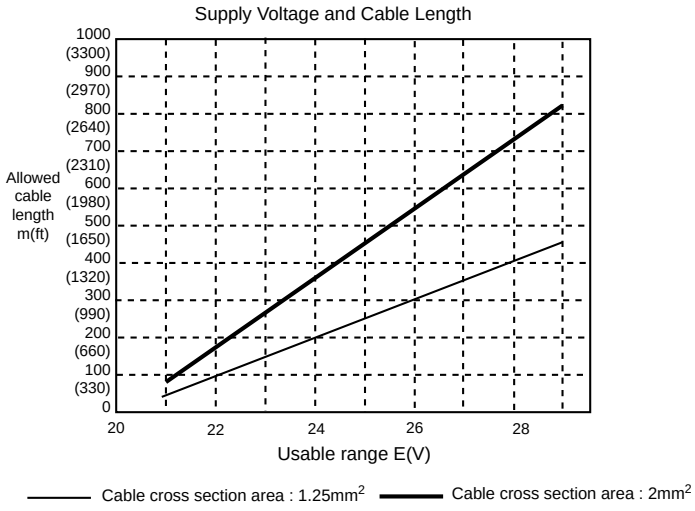
IMPORTANT

In case of 24V DC power supply, AC power supplies and polarities cannnot be connected in reverse. Although such a connection does not have a detrimental effect on the circuit itself, it will cause the fuse to melt.

(2) Supply Power Rating for 24VDC

IMPORTANT

In case of 24V DC power supply, the specification for the supply voltage is 24V DC (-15% to +20%), but the input voltage of the converter drops due to cable resistance so it should be used within the following range.



(3) Setting Power Supply Frequency

IMPORTANT

In case of DC power supply version, the frequency of the power supply has to be adjusted. Please adjust for the local power frequency. The power supply frequency is set in parameter B12. Refer to 5.4 or 6.2.4 for data setting procedures.

3.2.5 Wiring Ports

Please select the most suitable standard of wiring procedure for the wiring ports by customer's own.

(1) Wiring Using Waterproof Gland

IMPORTANT

To prevent water or condensate from entering the converter housing, waterproof glands are recommended. Do not over-tighten the glands or damage to the cables may result. Tighteness of the gland can be checked by confirming that the cable is held firmly in place.

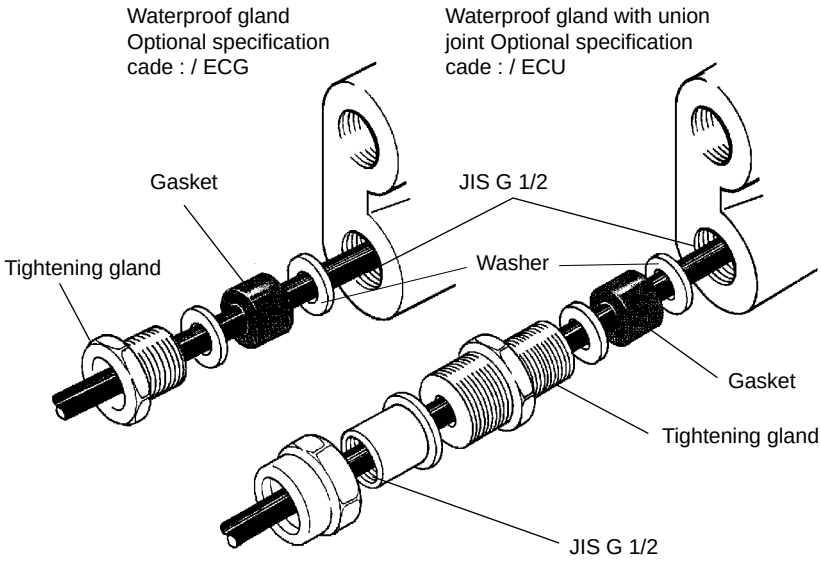


Figure 3.2.4 Waterproof Gland

(2) Conduit Wiring

In case of conduit wiring, please use the water proof gland to prevent water flowing through the conduit pipe into the wiring connection. Please slope the conduit pipe down, and install a drain valve at the low end of the vertical pipe. Please open the drain valve regularly.

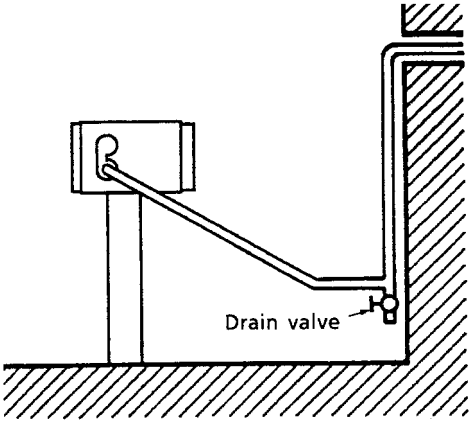


Figure 3.2.5 Conduit Wiring

3.2.6 Connecting to External Instruments

CAUTION All the devices to be connected to current output and pluse output must be conformed to CSA1010, CSA950, IEC1010 or IEC950.

(1) Analog Signal Output (4 to 20mA DC signal is output)

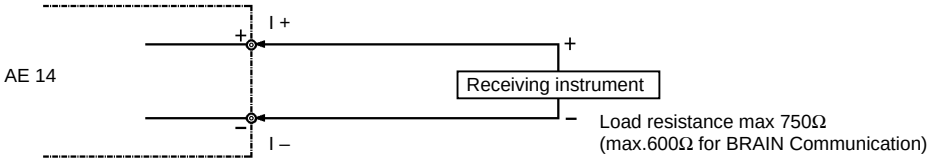


Figure 3.2.6 Connection for Analog Signal Output

(2) Pulse Output

Please give attention to voltage and polarity in wiring, because it is transister contact (Insulation type).

IMPORTANT

- In case of the filtering constant of Electric Counter is more than the pulse width, it makes signal decreases and can't be calculated correctly.
- In case of input impedance of Electric Counter is large, inductive noise from power supply bring bad influence to measurement. To calculate correctly, it is recommended to use sealed cable or to make input impedance small enough within the limits of pulse output of Magnetic Flow Converter.

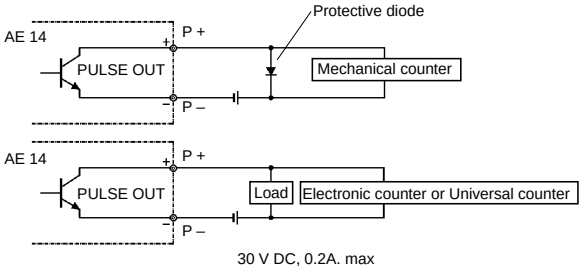


Figure 3.2.7 Pulse Output Connection

(3) Alarm Output

IMPORTANT

This is a transistor contact (insulated type) so attention must be paid to voltage and polarity when making connections.

This output cannot switch an AC load. To do this, another relay (see the right figure) is required. * The alarm output works “close”(Normal) and “Open”(Alarm occurs).

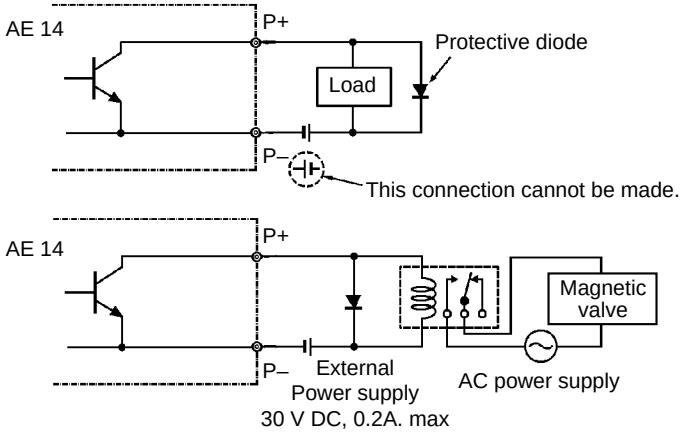


Figure 3.2.8 Contact Output Connection

4. BASIC OPERATING PROCEDURES

All data settings can be performed with the three keys on the front panel (SET, SHIFT and INC) or using a handheld BRAIN (BT) terminal.

The following sections describe basic data configurations and how to use the three panel keys. (See chapter 6 for information on BT operations.)

4.1 Liquid Crystal Display

Figure 4.1 shows the configuration of the ADMAG AE display panel (if equipped).

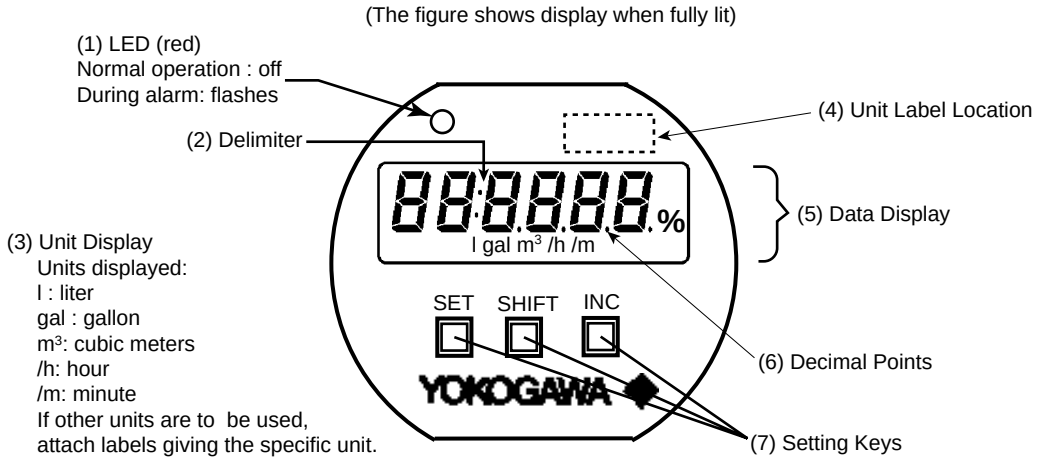
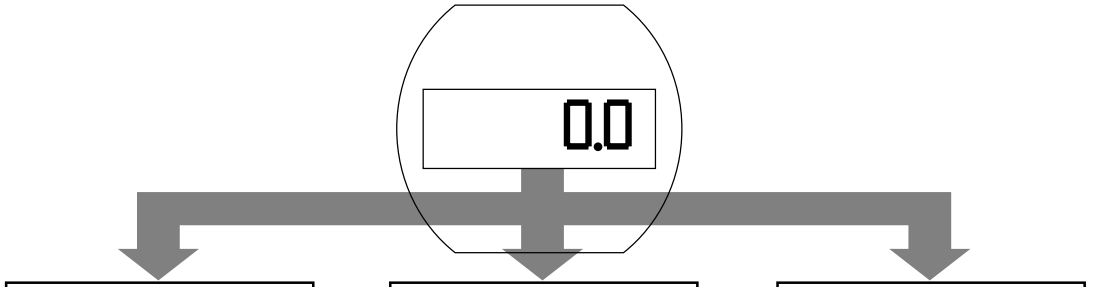


Figure 4.1 Configuration of Display

(1) LED (red)	:	This LED is off during normal operation and flashes when an alarm condition has occurred.
(2) Delimiter	:	The delimiter " : " (colon) indicates that the displayed data is in setting mode.
(3) Unit Display	:	Displays flow rate units. In order to display other units, the required unit label should be selected from the provided data sheets and attached as shown.
(4) Unit Label Location	:	To display units not on the LCD, select the required label from the provided data sheets and attach it here.
(5) Data Display	:	Displays flow rate data, setting data and type of alarm generated.
(6) Decimal Point	:	Displays decimal point in the data.
(7) Setting Keys	:	These keys are used to change flow rate data displays and type of setting data.

4.2 Types of Display Data

Three major types of data are displayed.



1. Flow Rate Data Display Mode

This mode displays flow rates and totalization date. Go to the setting mode and use parameter "**d1**" to change display items. This mode can be called up by pressing "SET" key while pressing "SHIFT" key when setting mode is displayed.

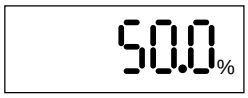
2. Setting Mode

This mode is used to check parameter content and rewrite data. This mode can be called up from the flow rate data display mode by pressing the "**SET**" key.

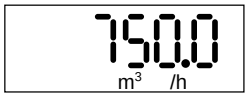
3. Alarm Display Mode

When an alarm situation occurs, this mode will replace the current mode (flow rate or setting mode) to show what type of alarm has occurred.

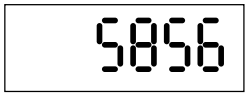
■ **Display Example)**



(Flow rate %)



(Actual flow rate)



(Flow rate totalization value)

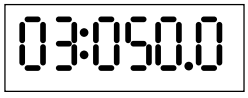
(Alternate display of flow rate % and flow rate totalization value)

(Alternate display of actual flow rate and flow rate totalization value)

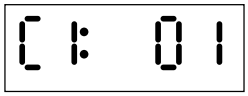
(Alternate display of actual flow rate and flow rate %)

■ **Display Example)**

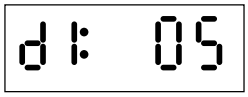
(Data item 02: 3 sec.dumping)



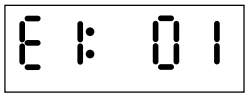
(Data item 03: Span 50.0)



(Data item C1: Zero adjust not possible)

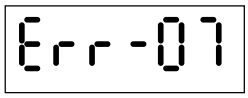


(Data item d1: Selection of display items)

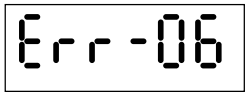


(Data item E1: Selection of totalization units)

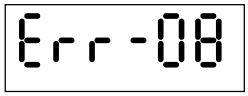
■ **Display Example)**



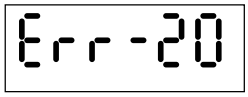
(Error 07: Coil open)



(Error 06: Input signal error)



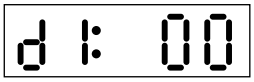
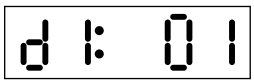
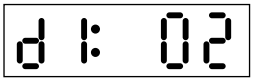
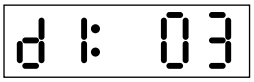
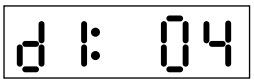
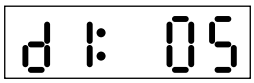
(Error 08: Incorrect span setting)



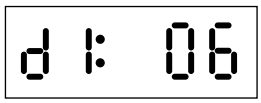
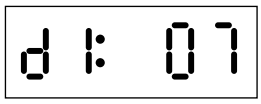
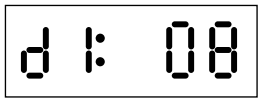
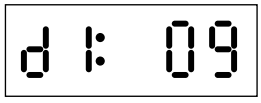
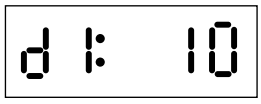
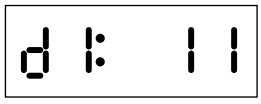
(Error 20: Metering tube not filled with water)

4.2.1 Flow Rate Data Display Mode

- The flow rate data display mode indicates instantaneous flow and totalized flow values.
  The ADMAG AE can display 12 types of flow rate data.
- This functions can be set in the parameter "d1" key of the flow converter.
- For changing from setting mode to flow rate data display mode, press "SET" key while pressing "SHIFT" key.
- When a BT is used, call up the "D01 DISP SELECT" parameter to select functions.

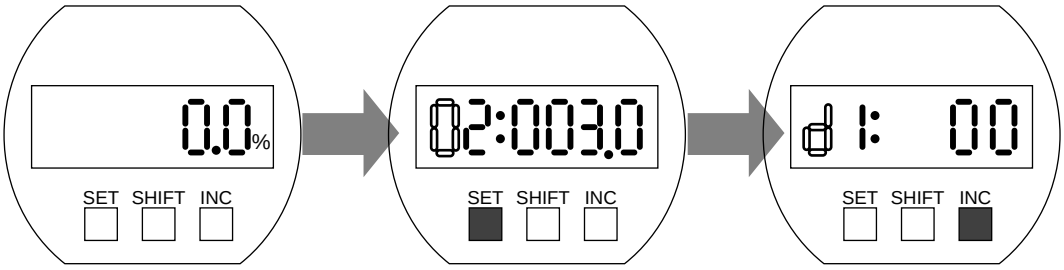
Display item	Content	ADMAG AE Setting	BT Setting
Forward Flow Rate %	Instantaneous flow rate is displayed within a range of -8.0(-108.0) to 108 for the span.		**D01 : DISP SELECT RATE(%)**
Actual forward Flow Rate	The actual meter rate of instantaneous flow rate is displayed. (See note 1.) The decimal place is the same as for the span setting. However,since a decimal point set at the most significant bit cannot be displayed. It is automatically shifted 1 digit to the right. (BT setting of 0.0001 is displayed as 0.000 on the ADMAG.)		**D01 : DISP SELECT RATE**
Forward flowrate totalization values	Display forward flow rate totalization value		**D01 : DISP SELECT FOR.TOTAL**
Reverse flowrate totalization values	Display reverse flow rate totalization value		**D01 : DISP SELECT REV.TOTAL**
Differential Between the forward and reverse totalization values	Differential totalization, between forward totalization and reverse totalization, is displayed.		**D01 : DISP SELECT DIF. TOTAL**
Forward flowrate (%) and Forward totalization values	Display alternately between display of "RATE(%)" and "FOR. TTL" every 4 second interval.		**D01 : DISP SELECT RATE%/FOR.TTL**

Note 1 : The LCD can display the following combination of units (by selecting a parameter)
Units other than those shown below can be displayed by attaching the provided unit labels .
l (liters) /h, l (liters) /m, m^3/h, m^3/m, gal/h, gal/m

Display item	Content	ADMAG AE Setting	BT Setting
Alternate display of actual forward flowrate and flowrate totalization values	Display alternately between display of "RATE" and "FOR. TTL" every 4 second interval.		**D01 : DISP SELECT RATE/FOR.TTL**
Alternate display of actual forward flowrate and forward flowrate (%)	Display alternately between display of "RATE" and "RATE(%)" every 4 second interval.		**D01 : DISP SELECT RATE/RATE(%)**
Alternate display of forward flowrate (%) and reverse totalization values	Display alternately between display of "RATE(%)" and "REV. TTL" every 4 second interval.		**D01 : DISP SELECT RATE(%)/REV.TTL**
Alternate display of forward flowrate and reverse flowrate totalization values	Display alternately between display of "RATE" and "REV. TTL" every 4 second interval.		**D01 : DISP SELECT RATE/REV.TTL**
Alternate display of forward flowrate (%) and differential between the forward and reverse totalization values	Display alternately between display of "RATE(%)" and "DIF. TTL" every 4 second interval.		**D01 : DISP SELECT RATE(%)/DIF.TTL**
Alternate display of forward flowrate and differential between the forward and reverse totalization values	Display alternately between display of "RATE" and "DIF. TTL" every 4 second interval.		**D01 : DISP SELECT RATE/DIF.TTL**

(1) Changes in Flow Data Display Items

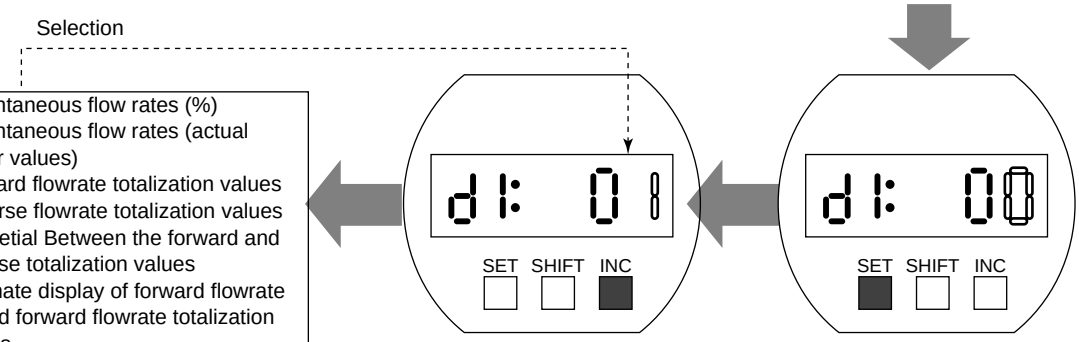
- Shows how the display changes when the flow converter switches are pressed.
- See chapter 6 for information on changes using the BT200.



The display shown when the power is turned on.

Press the **SET** key to go to the data mode shown above.

Press the **INC** key twice to display **d1:00**.

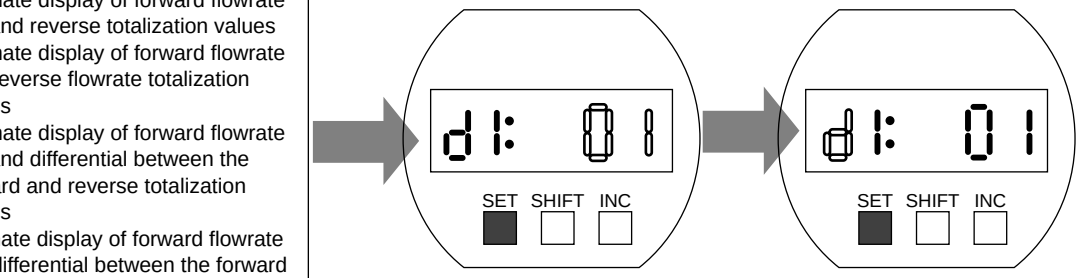


Press the **SET** key to move the hached portion (flashes) to the last digit.

Press the **INC** key to select the number of the desired display type.

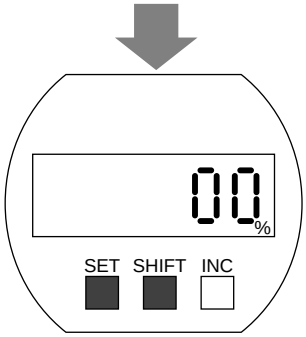
Selection

00 : Instantaneous flow rates (%)
01 : Instantaneous flow rates (actual meter values)
02 : Forward flowrate totalization values
03 : Reverse flowrate totalization values
04 : Differetial Between the forward and reverse totalization values
05 : Alternate display of forward flowrate % and forward flowrate totalization values
06 : Alternate display of forward flowrate and flowrate totalization values
07 : Alternate display of forward flowrate and forward flowrate (%)
08 : Alternate display of forward flowrate (%) and reverse totalization values
09 : Alternate display of forward flowrate and reverse flowrate totalization values
10 : Alternate display of forward flowrate (%) and differential between the forward and reverse totalization values
11 : Alternate display of forward flowrate and differential between the forward and reverse totalization values



Press the **SET** key once and all data starts to flash.

Wait 2 to 3 seconds and press the **SET** key again to return the hatched portion to its original position.



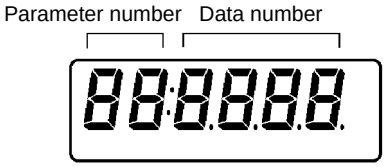
When all setting have been made, hold down the **SHIFT** key while pressing the **SET** key to return to original display mode.

4.2.2 Setting Mode

- The setting mode is used for checking parameters and rewriting data.
- The following is an overview of the setting mode. See Section 5 "Function and Data Settings" for detailed information.

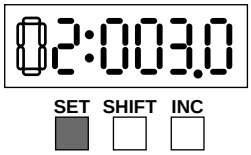
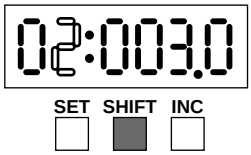
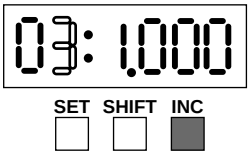
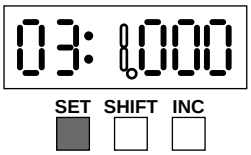
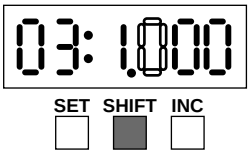
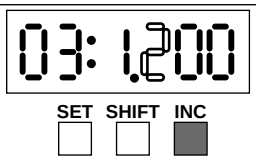
(1) Structure of Setting Mode Display

- The display consists of two areas ; two digits to the left of the colon and four digits to the right of it.
- Two types of data can be entered : direct entry of numerals and entry of desired data items using codes.
  Refer to "Parameter list" in chapter 11 for information on how to change settings.

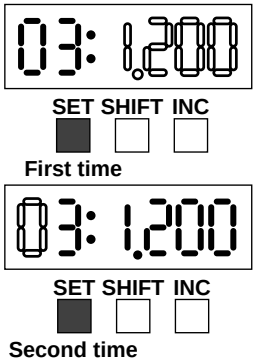
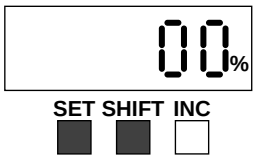


(2) Procedures for Setting and Changing Data

Example of parameter change : Changing the span (number 03) from 1.000 to 1.200

Item	Display	Content
① **Switch to "Setting Mode"**		Press the **SET** key to go from the flow rate data display to the setting mode.The delimiter ":" is displayed to indicate that the mode has been swiched.
② **Parameter Selection**		Press the **SHIFT** key to move the flashing segment (the selected item)
		Use the **INC** key to change the items displayed in the flashing segment(the selected item). ∗ Parameter 03 contains 5-digit data which cannot be displayed as shown on the left but has to be scrolled.
③ **Data Rewrite**		Use the **SET** key to move the flashing segment (the selected item) to the most significant location of the data area.
		Use the **SHIFT** key to move the flashing segment (the selected item) within the data area.
		Use the **INC** key to change the data area (numeric data) in the flashing segment (the selected item).

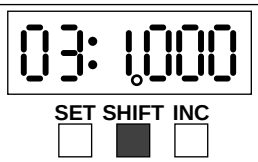
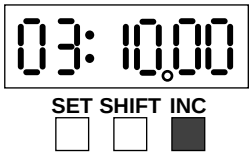
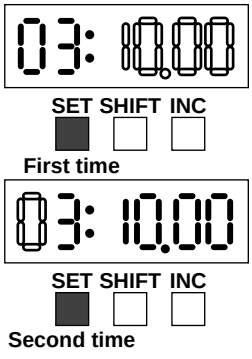
---Continued---

Item	Display	Content
④ **Data Input**		Press the **SET** key twice to enter data. (All data will start flashing when the key is pressed the first time. Then wait 2 to 3 seconds before pressing the key the second time.)
⑤ **Switching to Flow Data Entry**		Hold down the **SHIFT** key and press the **SET** key to switch to the flow rate data display.

(3) Procedures for Changing Decimal Place

Before starting this procedure check in the data list if the position of the decimal point for the desired parameter decimal places can be changed.

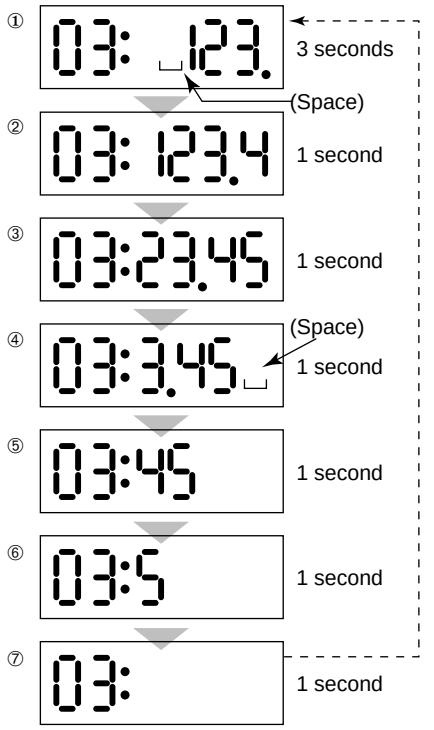
Example of parameter change : Changing the span from 1.000 to 10.00

Item	Display	Content
① **Selecting Decimal Position**		Press the **SHIFT** key to move the flashing segment to the decimal point.
② **Moving Decimal Portion**		Press the **INC** key to move the decimal point to the right.
③ **Data Entry**		Press the **SET** key twice to enter data. (All data will start flashing when the key is pressed the first time. Then wait 2 to 3 seconds before pressing the key the second tme.)

(4) Display of 5-digit Data

- The data display area has four digits and can therefore not display span and other 5-digit data parameters.
  To display such data, the data is automatically shifted (scrolled) to the left one digit at a time .
  When a 5-digit parameter is selected, the delimiter " : " starts to flash.
- When the flashing segment is aligned with the last digit and the data includes a space, the data is displayed as shown ④ on the right.

Display example : Display of span 123.45

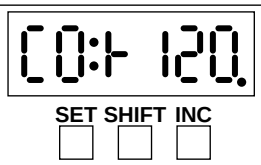
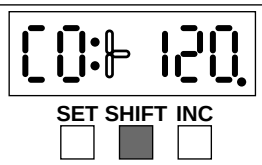
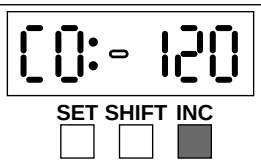


(5) Display of 6-digit Data

- The data display area has four digits and can therefore not display span and other 6-digit data parameters. (E05 TL SET VALUE is the only 6-digit parameter.)
  Like 5-digit data, 6-digit data is displayed by automatically shifting (scrolling) it to the left one digit at a time.

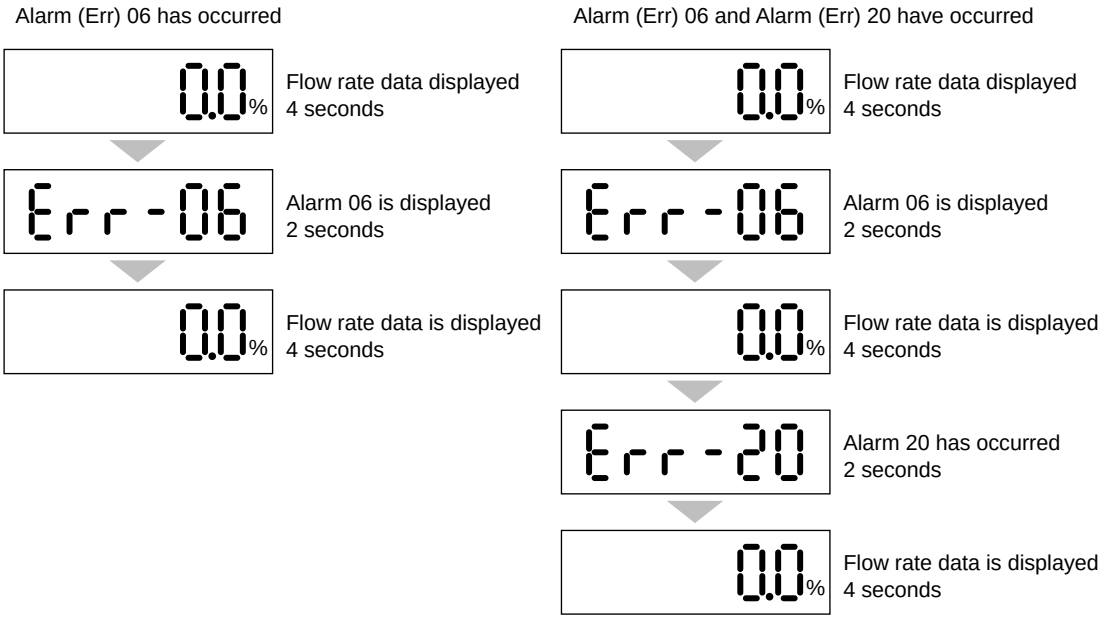
(6) Display and Setting Coded Data

- Example of change : Changing from +120 to -120

Item	Display	Content
1. Selecting Coded Data		The display on right indicates "+120".
2. Coded Data Flashes		Cause the "+" sign to flash.
3. Change of Coded Data		Press the **INC** key to change the "+" sign to a "-" sign. Press the **SET** key twice.

4.2.3 Alarm Display Mode

- When an alarm occurs, an alarm number indicating is displayed in place of the normal display mode.
  However, this happens only when the current display mode is the flow rate data display mode or when parameter number are being changed in the setting mode. (Alarms are not displayed when data items are being changed.)



- **See the section 7.2 "Self diagnostics function for information on alarm numbers.**

5. FUNCTION AND DATA SETTINGS

A magnetic flowmeter calculates volume flow rate from minute voltage that corresponds to the flow velocity of a fluid and outputs a 4 to 20mA signal.

NOTE The three parameters must be set to obtain a correct signal. Nominal size, flow span and meter factor must be set.

This chapter explains how to set flow span and other functions.

Please set data correctly.

You cannot set the leftmost digit of display to numeric value greater than "4". If the leftmost digit of the span must be "4" or more, set the numeric value beginning from the digit second from the left on the display (the fourth digit). If the leftmost digit of the display is set to "3", the digits to its right can be set to "0" only, regardless of the decimal point position.

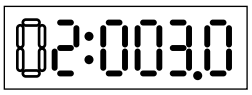
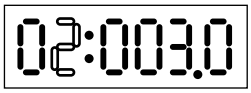
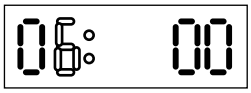
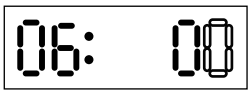
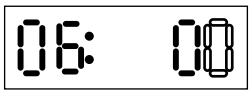
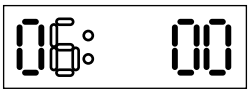
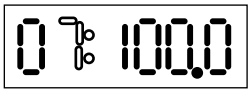
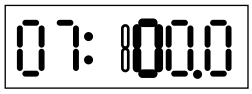
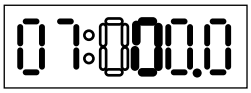
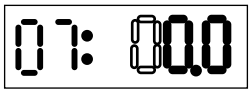
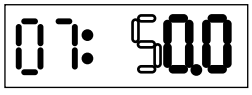
NOTE

Basic Key Operations

Item	Key Operation
How to change the display into the setting mode?	SET
How to move the cursor on the display during parameter setting?	SHIFT
How to change the display into the data changing mode?	SET
How to move the cursor in the data changing mode?	SHIFT
How to change the data?	INC
How to input the set data?	SET (Twice)

5.1 Setting Nominal Size

Data Example : flowtube size 50mm

Switch Operation	Display	Description
SET SHIFT INC		Press the **SET** key during flow rate data display mode to display setting mode shown in the left figure.
SET SHIFT INC		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC		Press the **INC** key to call up parameter number 06.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC		Press the **INC** key to select code "0" or "01" to display "mm" or " inch".
SET SHIFT INC Twice		Press the **SET** key twice.
SET SHIFT INC		Press the **INC** key to call up parameter number 07.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the first digit in the data area.
SET SHIFT INC		Set Flowtube size to number 07.
SET SHIFT INC		
SET SHIFT INC		
SET SHIFT INC Twice		After completing the changes, press **SET** key twice (wait slightly between presses), the setting is completed.

Code	Size Unit
00	mm
01	inch

5.2 Setting Flow Span

(1) Determining the Flow Rate Span Value

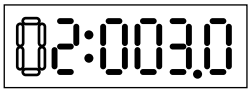
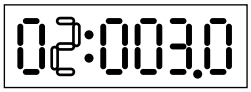
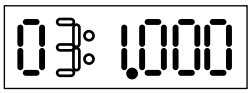
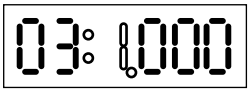
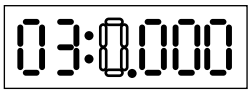
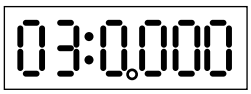
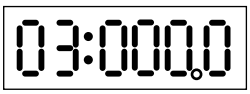
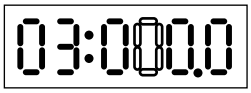
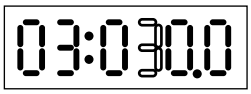
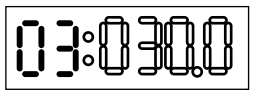
The flow rate span is the instantaneous flow rate value at which the output current is to be 20 mA.

Please determine the span under considering the followings.

- Please set the maximum flow rate at the most variable flow rate line. If the flow rate of the fluid exceeds the flow rate span value, the flow rate that exceeds this value (20mA or more) is not output and the meter will not display the correct flow rate (108% or more cannot be output).
- In a line where the flow rate is comparatively stable, set a value that is 1.5 to 2.0 times larger than the normal flow rate.
- Set a value that will correspond to a flow velocity of 0.3 to 10m/s.
  The flow velocity is checked using sizing data or parameter number "13". (Parameter number "13" displays the set span in flow velocity values.)
- The display of data is based on the input flow rate span value. It is recommended that the accuracy of the first digit is in a 0.05 to 0.1%. For example, 30 m^3/h should be set as 30.00m^3/h.
- The maximum numeric value that can be set is "30000" except any relation with decimal position.

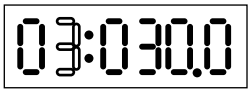
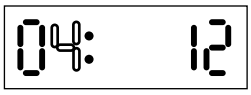
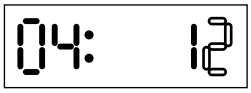
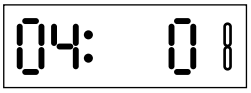
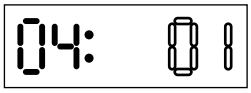
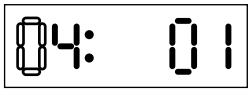
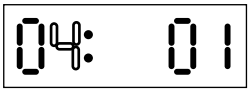
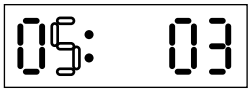
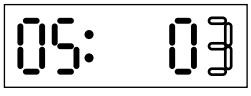
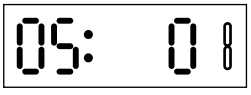
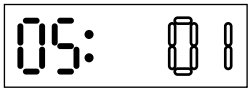
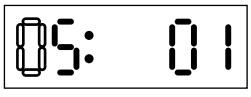
(2) Span Setting using Display Keys (Example setting: 30.00 m³/h)

- **Span Value Setting**

Switch Operation	Display	Description
SET SHIFT INC ■ □ □		Press the **SET** key during flow rate data display mode to display setting mode shown in the left figure.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC □ □ ■		Press the **INC** key to call up parameter number 03. Default is set as 1.0000. Change this into 030.000
SET SHIFT INC ■ □ □		Press the **SET** key to move the flashing segment to the first digit in the data area.
SET SHIFT INC □ □ ■		Press the **INC** key to set the first digit to 0.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the decimal point.
SET SHIFT INC □ □ ■		Press the **INC** key to move the decimal point to "000.00". *To set a "00000." as the data area is a four digit LCD, the three digits and the space will be displayed as "000".
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the flashing segment two digits to the right.
SET SHIFT INC □ □ ■		Press the **INC** key to enter "3".
SET SHIFT INC ■ □ □		Press the **SET** key once to cause all the data to flash. *As the data display now will be scrolled, it may not appear as shown in the left figure.
SET SHIFT INC ■ □ □	 (Setting is now completed)	Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the leftmost digit. *This display will also be scrolled to display 5-digit data.

Note : 5-digit span data can be displayed, but only 4 digits will be supplyed at one time. As a result, when the last digit is changed, the last digit and the space will be displayed as the last three digits. (See 4.2.2 "Display of 5-digit data".)

• Setting Volume Measurement (m^3) and Time Unit (/h)

Switch Operation	Display	Description
(↓ Selecting m^3)		
SET SHIFT INC		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC		Press the **INC** key to call up parameter number 04.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC		Press the **INC** key to select "01" to display m^3.(See the table on the right.)
SET SHIFT INC		Press the **SET** key once to casue all the data to flash.
SET SHIFT INC		Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the lesfmost digit.
(↓ Selecting /h)		
SET SHIFT INC		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC		Press the **INC** key to call up parameter number 05.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC		Press the **INC** key to select the code "01" to display /h. (See the table on the right.)
SET SHIFT INC		Press the **SET** key once tocause all the data to flash.
SET SHIFT INC		Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the leftmost digit.
	(Setting is now completed.)	

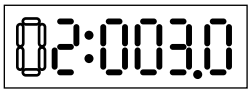
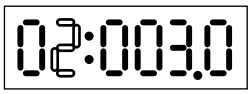
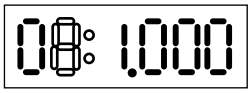
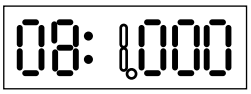
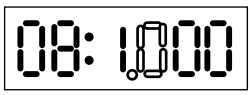
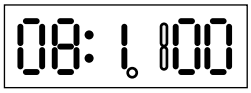
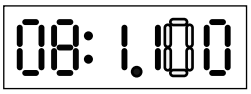
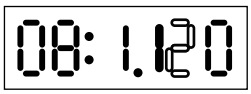
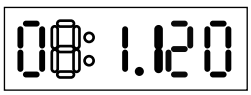
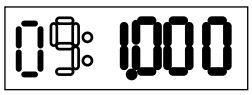
Code	Volume Unit
00	$km^3(10^3 \times m^3)$
01	m^3
02	l(liter)
03	$cm^3(10^{-2} \times m)^3$
04	Mgal
05	kgal
06	gal
07	mgal
08	kbbl
09	bbl
10	mbbl
11	µbbl
12	m
13	ft

Code	Time Unit
00	/d
01	/h
02	/m
03	/s

5.3 Setting Meter Factor

The meter factors are engraved on the data plate of the combined flow tube.

Data Example : Meter factor (L) : 1.1200
Meter factor (H) : 1.2300

Switch Operation	Display	Description
SET SHIFT INC ■ □ □		Press the **SET** key during flow rate data display mode to display the setting mode shown in the left figure.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC □ □ ■		Press the **INC** key to call up parameter number 08.
SET SHIFT INC ■ □ □		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the flashing segment two digits to the right.
SET SHIFT INC □ □ ■		Press the **INC** key to enter "1".
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the flashing segment to the right.
SET SHIFT INC □ □ ■		Press the **INC** key to enter "2".
SET SHIFT INC ■ □ □		After completing the changes, press SET key twice (wait slightly between presses) , the data setting is completed.
SET SHIFT INC □ □ ■		Set meter factor(H) to number 09. Set in the same way.

5.4 Power Frequency (For DC version only)

IMPORTANT In case of DC power supply version, setting power frequency is required in areas where the frequency differs.

Display	Description
12:50.00 Default:50.00Hz	Set the value in area where the frequency differs in parameter number "12". Setting Range : 47.00 to 53.00Hz.

5.5 Other Functions and Settings

5.5.1 Pulse Output

(1) Pulse Output Overview

- By setting a pulse weight, a scaled pulse is transmitted to external counters and measuring instruments.

Pulse Output Overview

Item	Content
Output specifications	Transistor contact output(contact capacity is 30 V DC,200mA)
Connecting terminals	P+,P- When using these for pulse output, alarm output or status output are not available as the terminals are used commonly.
Pulse width	Selection : DUTY50%, 0.5, 1, 20, 33, 50,100ms
Output rate	Min. 0.0001 P/s Max. 1000 P/s

* See "3.2.7 Connecting external instruments" for information on how to connect external instruments.

NOTE P+, P- terminals are for common use with pulse, alarm and other status output functions. Therefore, in case this function is used, other functions are not available to use.

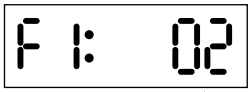
(2) Procedures for Setting Pulse Output

Example setting : 10 liter output per pulse in a flow rate span of □□□ m^3/h

Display	Description
10: 00	Select "Pulse output" in parameter number "10".

Code	Contents
00	Pulse output
01	Alarm output
02	Forward/reverse flow measurement
03	Automatic two range switching
04	Alarm output at low flow limit
05	Totalization switch

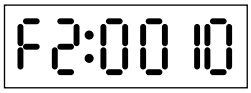
Display	Description



Select the volume unit for pulse weight using parameter number "**F1**".

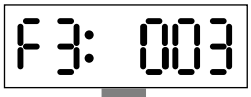
Code	Volume Unit
00	Volume unit in that for the flow rate span $\times 10^{-9}$
01	Volume unit in that for the flow rate span $\times 10^{-6}$
02	Volume unit in that for the flow rate span $\times 10^{-3}$
03	Volume unit in that for the flow rate span $\times 1$
04	Volume unit in that for the flow rate span $\times 10^{3}$
05	Volume unit in that for the flow rate span $\times 10^{6}$
06	Number of pulses output per second at 100% of output

Example : When pulses are to be output per same liter with the flowrate span of □□ m^3/h, select "**02**" since L(liter) = $10^{-3} \times m^3$



Set pulse weight "**10 (**L**)**" in parameter number "**E2**".

※ Since parameter number "**F2**" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when setting are made. (The decimal point can be moved if required.)



Default : 3%

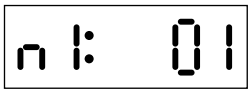
Set the low cut range percentage in parameter "**F3**".
Range of setting : 0 to 100% (of span)

Default : 50%DUTY

Select the pulse width in parameter number "**F4**".

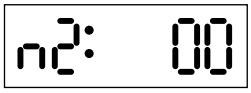
Code	Pulse Width		
00	50%DUTY	(Max. 1000P/s	min. 0.0001P/s)
01	0.5ms	(Max. 1000P/s	min. 0.0001P/s)
02	1ms	(Max. 500P/s	min. 0.0001P/s)
03	20ms	(Max. 25P/s	min. 0.0001P/s)
04	33ms	(Max. 15P/s	min. 0.0001P/s)
05	50ms	(Max. 10P/s	min. 0.0001P/s)
06	100ms	(Max. 5P/s	min. 0.0001P/s)

Normally, these are all required settings. The following settings are made depending on the applications that are used.



Default : 01
(Damped flow rate value)

Select instantaneous flow rate or flow rate after damping for the pulse output. (The damped value is the value set in "**02**".)



Default : 00(ON ACTIVE)

Set parameter "**n2**" to "**01**" when the pulse output transistor is to be off active.

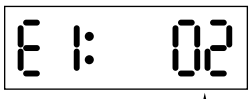
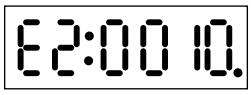
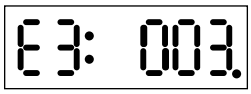
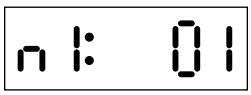
*The "n" item can be opend by entering "55" in paramter number "L2".

5.5.2 Display of Internal Totalization Values

- The flow converter can display totalization values by setting the pulse weight.

(1) Setting Totalization Pulse Weight

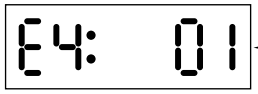
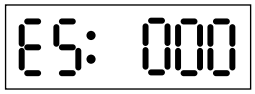
Example : Display 10 liter output per pulse in a flow rate span of □□□ m^3/h

Display	Description
	Select the volume unit for pulse weight using parameter number "**E1**".
	Code / **Volume Unit** 00 Volume unit in that for the flow rate span $\times10^{-9}$ 01 Volume unit in that for the flow rate span $\times10^{-6}$ 02 Volume unit in that for the flow rate span $\times10^{-3}$ 03 Volume unit in that for the flow rate span $\times1$ 04 Volume unit in that for the flow rate span $\times10^{3}$ 05 Volume unit in that for the flow rate span $\times10^{6}$ 06 Number of pulses output per second at 100% of output
	Example : When pulses are to be output per same liter with the flow rate span □□ m^3/h, select "**02**" since L(liter) = $10^{-3}\times m^3$
	Set pulse weight "**10 (**L**)**" in parameter number "**E2**".
	※ Since parameter number "E2" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when setting are made. (The decimal point can be moved if required.)
 Default : 3%	Set the low cut range percentage in parameter "E3". Range of setting : 0 to 100% (of span)
 Default : 01 (Damped flow rate value)	Select pulse output calculation of instantaneous flow rate or flow rate after damping. (Use parameter "02" to set damping constant.)

*Item "**n**" can be opened by entering "**55**" in parameter number "**L2**".

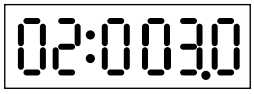
5.5.3 Resetting for Totalization Display

- This function is used to reset or preset totalization values of the display.
- Hold down the SHIFT key for more than 2 seconds while the totalization values of the flow rate are displayed to set the totalization value to the value set in parameter number "E5".

Display	Description
 Default : 00 (inhibit)	Select totalization enable in parameter number "**E4**"
	Code / **Description** 00 — Totalization presetting inhibit 01 — Totalization presetting enabled
 Default : 0	Set the totalization preset value in parameter number "**E5**". The initial value is 0, if it is no setting, the function is zero setting.
SET SHIFT INC	Hold down the **SHIFT** key for more than 2 seconds while the totalization values of the flow rate reading are displayed to set the totalization value to the value set in parameter number "**E5**"

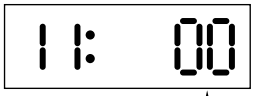
5.5.4 Damping Time Constant

- The time constant can be changed by setting the parameter number "02" to suppress a fluctuation or change a response time.
- The time constant influences to flow rate, pulse output and internal totalization. However, in case "00" is selected in parameter number "N1", the pulse output and internal totalization are not influenced by it.

Display	Description
 Default : 3 seconds	Set the value in parameter number "**02**". Range of possible settings : 0.1 to 200.0 seconds.

5.5.5 Current Output During Alarm Occurrence

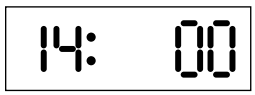
• The current output and display values during alarming can be selected in advance.

Display	Description
 Default : 00 (2.4 mA or less)	Set a value for current output to be used during alarms in parameter number "**11**"

Code	Contents
00	2.4mA or less
01	4.0mA
02	Hold
03	21.6mA or more

5.5.6 Reversing Flow Direction

• The flow direction is set to "FORWARD" at the factory. This function enables to set flow direction from "FORWARD" to "REVERSE"

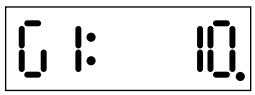
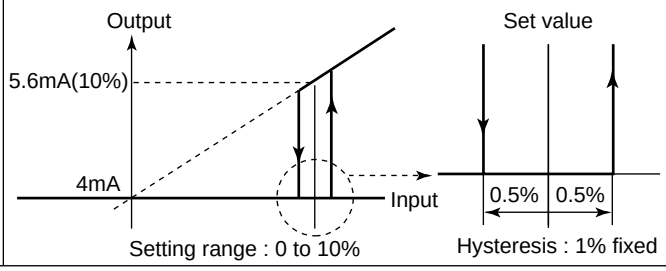
Display	Description
 Default : 00	Set the flow direction in parameter "14".

Code	Contents
00	Forward direction
01	Reverse direction to flow arrow

5.5.7 Limiting Current Output

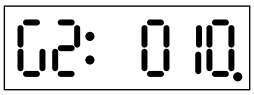
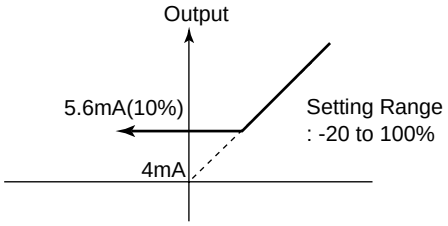
(1) 4 to 20 mA low cut output (Current Output near by 0% Range)

• This function makes it possible to reduce fluctuations in the 0% region to reduce it to 0%.

Display	Description
 Default : 0(%)	

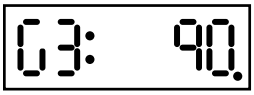
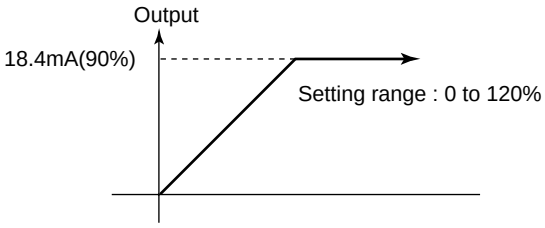
(2) 4 to 20mA Low Limit

- This function limits the low end of the analog output.
- The default value is -20%, and a -10% (2.4mA) as reverse flow limit. Please set in case other setting is required.
- 2.4mA or less output in alarming is also limited.

Display	Description
 Default : -20(%)	

(3) High Limit on Current Output

- This function limits the high end of analog output.
- The default value is 110% (21.6mA). Please set in case other setting is required.
- 21.6mA or more output in alarming is also limited.

Display	Description
 Default : 110(%)	

5.5.8 Forward and Reverse Flow Measurement

- This function enables to measure forward and reverse flow rate without change the detector direction.
- By setting reverse range, in case fluids flow to reverse direction the flowmeter measures it as reverse direction range automatically. In this time, a status signal that shows changing into the reverse direction is output.
- To set the internal totalizing function for forward direction can also show it for reverse direction by parameter settings.
- P+, P– terminals are used for output connection.

NOTE P+, P– terminals are for common use with pulse, alarm and other status output functions. Therefore, in case this function is used, other functions are not available to use.

Display

10: 02

30: 1.0000

31:0002.

(Default : 2%)

Description

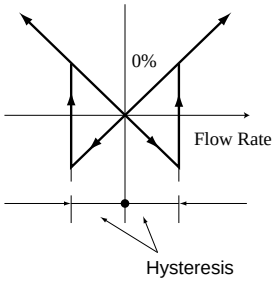
F and R flow rate measurement can be selected as "**02**" in parameter No. "**10**".

Code	Content
00	Pulse output
01	Alarm output
02	Forward / reverse flow measurement
03	Automatic two range switching
04	Alarm output at low flow limit
05	Totalization switch

Reverse direction span can be set in parameter No. "**30**".
Flow rate unit is the same as forward direction span.

Futher reverse range span should be set in the same number of places of decimals as forward range span.
Example: forward flow rate : 1.000 then revers flow rate should be 4.000.

Hysteresis width at switching direction can be set in parameter No. "**31**".
It is the rate (%) of the smaller span, either forward or reverse span.



Status output
Forward flow measurement: OFF
Reverse flow measurement: ON

When using reversed status (ON/OFF) is required, it can be set in "n2 Output Mode".

5.5.9 Automatic Two Range Switching

- When an input exceeds 100% of the first range, the range is automatically transferred to the second range and the status output changes state.
- P+, P– terminals are used for output connection.

> **NOTE**
>
> P+, P– terminals are for common use with pulse, alarm and other status output functions. Therefore, in case this function is used, other functions are not available to use.

Display

10: 03

Default : 00

33: 1.000

34:00 10

Default : 10%

Description

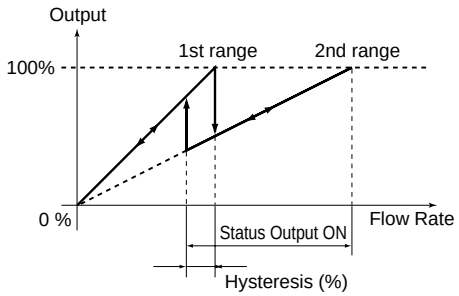
Automatic two range transfer can be selected "**03**" in parameter No. "**10**".

Code	Content
00	Pulse output
01	Alarm output
02	Forward / reverse flow measurement
03	Automatic two range switching
04	Alarm output at low flow limit
05	Totalization switch

Forward second range can be set by calling up parameter No. "**33**".
Setting restrictions: First range ≤ 2nd range.

Further second range span should be set in the same number of places of decimals as first range span in parameter No. "**03**".
Example: First range : 1.000 then second range should be 4.000

Hysteresis width at switching range can be set in parameter No. "**34**".
It is the rate (%) of first range span.



Status Output
1st range: OFF
2nd range: ON

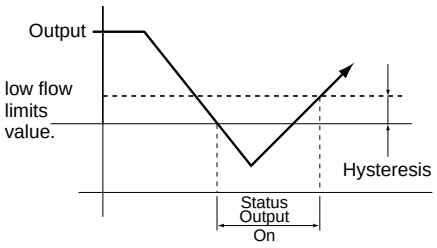
When using reversed status (ON/OFF) is required, it can be set in "n2 Output Mode".

5.5.10 Alarm Output at Low Flow Limit (Flow Switch)

- In case flow rate decrease under set level, an status signal is output.

NOTE

P+, P– terminals are for common use with pulse, alarm and other status output functions. Therefore, in case this function is used, other functions are not available to use.

Display	Description
10: 04 Default : 00	Alarm output at low flow limits can be selected "**04**" in parameter No. "**10**". **Code** / **Content** 00 Pulse output 01 Alarm output 02 Forward / reverse flow measurement 03 Automatic two range switching 04 Alarm output at low flow limit 05 Totalozation switch
36:-010 (Default : -10%)	The Low Limit value can be set in parameter No. "**36**" as percentage for 4 to 20 mA.
37:0005 (Default : 5%)	Hysteresis width is set in parameter No. "**37**".  When using reversed status (ON/OFF) is required, it can be set in "n2 Output Mode".

5.5.11 Totalization Switch Output

- In case the Internal Totalization Value increase over set level, an alarm signal is output.

NOTE

P+, P– terminals are for common use with pulse, alarm and other status output functions. Therefore, in case this function is used, other functions are not available to use.

Display

10: 05

Default : 00

E6:0000

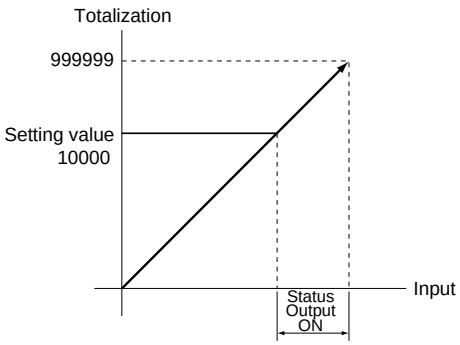
Default : 0

Description

Totalization switch can be selected as "**05**" in parameter No. "**10**".

Code	Content
00	Pulse output
01	Alarm output
02	Forward / reverse flow measurement
03	Automatic two range switching
04	Alarm output at low flow limit
05	Totalization switch

Switch level can be selected by calling up parameter No. "**06**".



When using reversed status (ON/OFF) is required, it can be set in "n2 Output Mode".

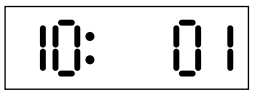
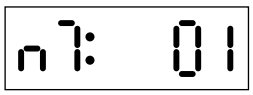
5.5.12 Alarm Output

- This function is for status output from P+, P– terminals, when an alarm occurs.

NOTE

P+, P– terminals are for common use with pulse, alarm and other status output functions.
Therefore, in case this function is used, other functions are not available to use.

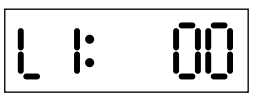
- All of the alarms are able to output except empty pipe detection function that can be selected in parameter No. “n7” as out of selection.
- The status goes from close to open (OFF) during alarming.

Display	Description
 Default : 00	The alarm output can be selected “**01**” in parameter No. “**10**” and P+, P– terminals are only for alarm output. **Code** / **Content** 00 Pulse output 01 Alarm output 02 Forward / reverse flow measurement 03 Automatic two range switching 04 Alarm output at low flow limit 05 Totalization switch
 Default : 00	The empty pipe output selection can be set in parameter No. “**n7**”. **Code** / **Content** 00 ALARM 01 NO ALARM

* Item "N" can be opened by entering "55" in parameter number "L2".

5.5.13 Data Setting Enable / Inhibit

- This function can inhibit to change all data except parameter No. “ L1”.
  However, auto zero adjustment function can work, if it has been set in parameter No. “C1”.
  And the preset totalization value function also can work, if it has been set in parameter No. “E4”.

Display	Description
 Default : 01	The data setting inhibit item can be set "00" in parameter number "L1". **Code** / **Content** 00 INHIBIT 01 ENABLE

5.5.14 Procedure of Selecting Special Application Items

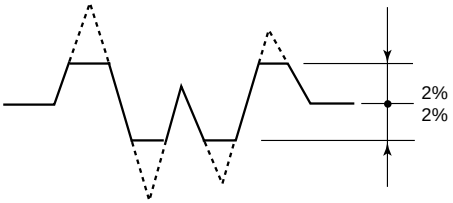
- Only the special apprication (“n” items) shipped being unpublished.
  In case the “n” items should be used, it can be set “55” in parameter No. “L2”.

Display	Description
L2: 55 Default : 00	It is possible to open up to item n when "55" is entered in parameternumber "L2". Code / Content 00 Accessible up to L parameters 01 Accessible up to n parameters

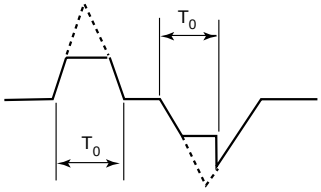
5.5.15 Rate Limit

- This function is used to remove noise that cannot be removed by increasing the damping time constant.
- In case unexpected noise from step signal or slurry is entered, a basis is set to recognize that signal is flow rate or noise.
  The recoginition depends on rate limit value (upper and lower limit) and dead time (sampling time).
- Determination of rate limit value and dead time.

Rate limit value:
Determine the level to reduce output fluctuation.
For example, reducing 2% or more fluctuation by setting as 2% to reduce.

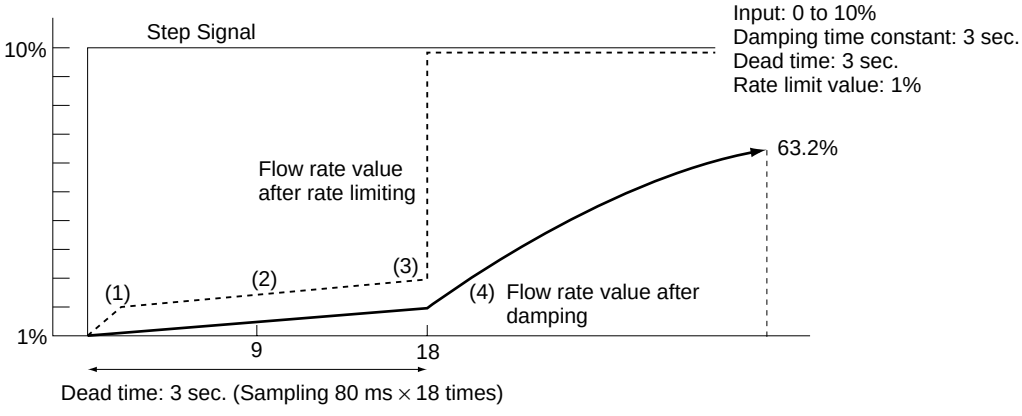


Dead time T_0:
Please determine the dead time depending on output fluctuation width.
In case of noise of which is longer than the dead time, please set the dead time longer.



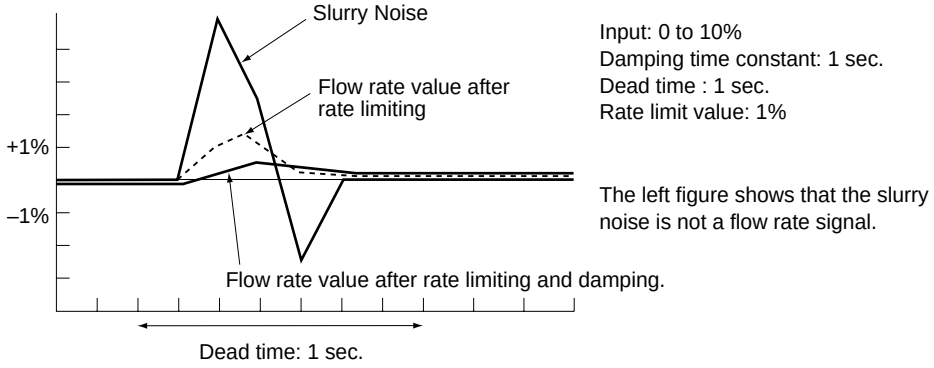
- **Signal processing procedures:**
  The function sets a certain upper and lower limit (rate limit value) for first order delay response values of flow rate data obtained in a previous sampling. If currently sampled flow rate data exceeds or goes below the limit is regarded as current flow rate value. Signals whose protruding portions show the same trends during a certain number of sampling times (dead time)are identified as flow rate signals..

Example 1: Step Input



(1) Shows 1% response cause of excessive signal beyond the rate limit. However, actual output is under damping that described by a solid line.
(2) Shows the flow rate signal (1%) of just after damping calculation (1) and rate limit value.
(3) This signal is recognized as a flow rate signal since it does not return to within the rate limit value within the dead time.
(4) The output signal follows the damping curve and tracks the step signal.

Example 2: Slurry Noise


Slurry Noise
Flow rate value after rate limiting
+1%
–1%
Flow rate value after rate limiting and damping.
Dead time: 1 sec.
Input: 0 to 10%
Damping time constant: 1 sec.
Dead time : 1 sec.
Rate limit value: 1%
The left figure shows that the slurry noise is not a flow rate signal.

Display	Description
n3: 05 Default : 5%	Set a rate limit value in parameter number "**N3**". Setting Range : 0 to 10%.
n4: 00 Default : 0sec	set the dead time in parameter number "**N4**". Setting Range : 0 to 15 seconds.

*Item "N" can be opened by entering "55" in parameter number "L2".

5.5.16 Pulsating Flow

- The pulsating flow produced by a plunger pump results in inaccurate average flow rate values. This function makes it possible to accurately track flow rate changes and control calculation.

Display	Description
n6: 01 Default : 00	Select "01" (pulsating flow counteraction) in parameter number "**N6**". **Code** / **Contents** 00 Nomal 01 Counteracting pulsating flow

6. OPERATION VIA BRAIN TERMINAL

Products provided with / BR (BRAIN communication function) come equipped with a BRAIN communication function which allows them to communicate with dedicated brain terminals (BT) or CENTUM-XL / CS. In the BRAIN - Series communications system, a ±2 mA, 2.4 kHz modulated signal is superimposed onto the 4 to 20 mA DC analog signal for data transmission. Since the modulated wave is an AC signal, superimposed on the analog signal will cause no error in the DC component of the analog signal. Thus, monitoring can be performed via communications while the ADMAG AE is online.

A BRAIN Terminal can be connected to the terminals shown in Figure 6.1 on products that are not provided with a / BR (BRAIN communication function).

6.1 Operation Via the BT200

This section describes the operation procedures using a brain terminal. For details on the functions of the ADMAG AE, see Chapter 5, "Function and Data Settings." And also, see the "BT200 Instruction Manual" (IM IC0A11-01E) for more detailed information.

6.1.1 BT200 Connections

(1) Connecting BT200 to Converter

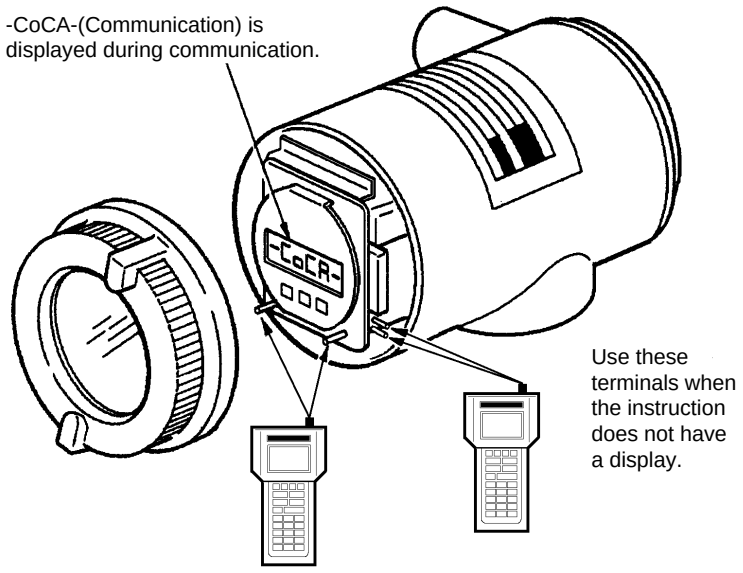

-CoCA-(Communication) is displayed during communication.
-CoCA-
Use these terminals when the instruction does not have a display.

Figure 6.1 Connection of BT200 to Flow Conerte

For products not provided with the / BR (BRAIN communication function), the terminals for BRAIN communication are provided on the circuit board. Please connect BT200 to the terminals on the circuit board directly.

(2) Connecting the BT200 to a 4 to 20 mA DC Transfer Line

The communication signal of the ADMAG AE with the / BR function (optional specification) is superimposed onto the 4 to 20 mA DC analog signal to be transferred.

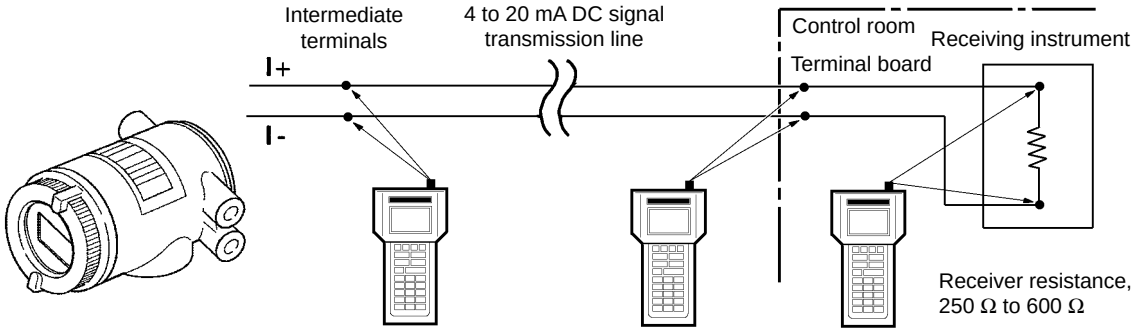


Figure 6.2 Communicating via a 4 to 20 mA DC Signal Line

6.1.2 BT200 Keypad Layout

Figure 6.3 shows the key pad lay out of the BT200.

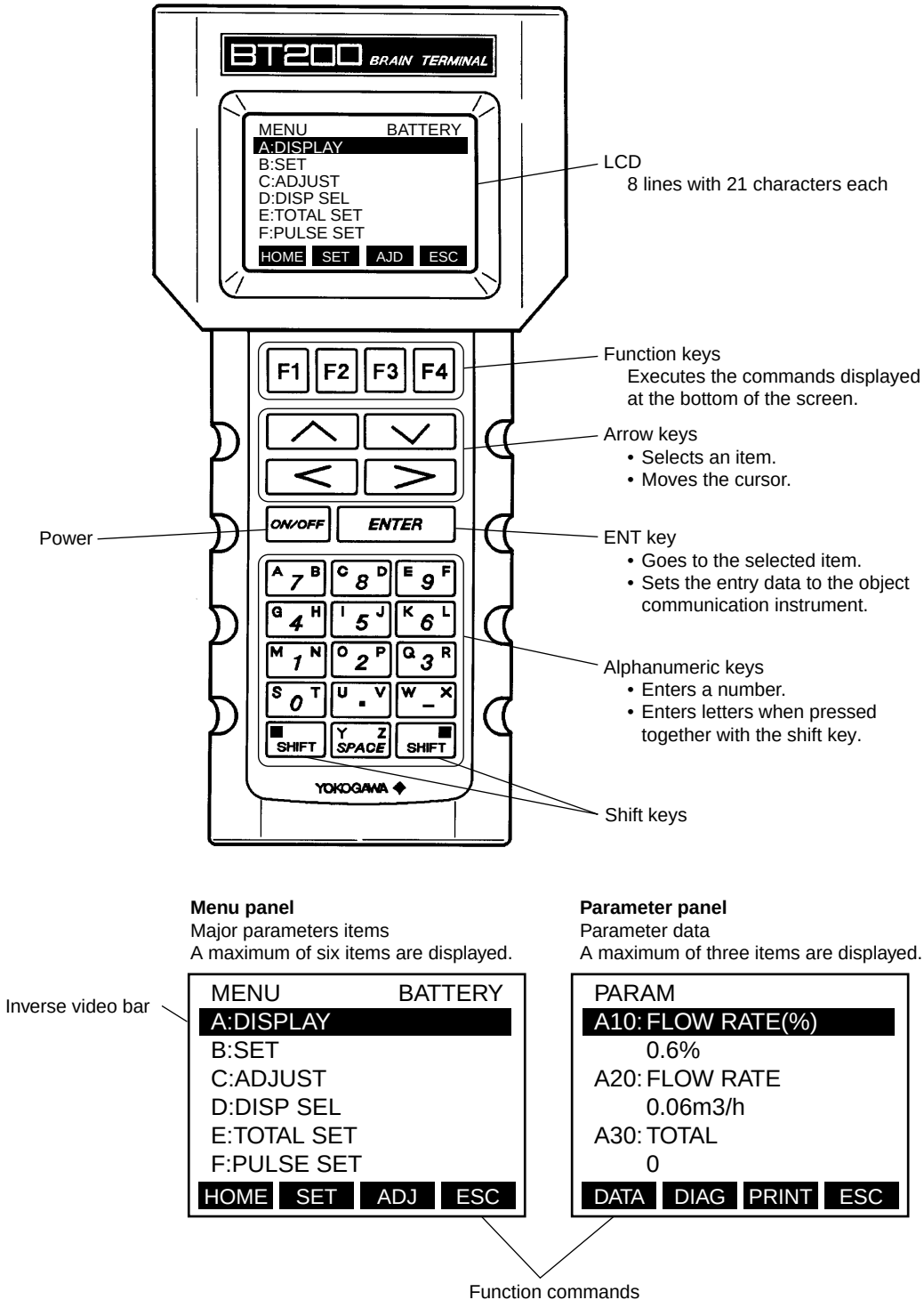


Figure 6.3 Key Layout and Functions

6.1.3 Major BT200 Key Functions

(1) Entry of Alphanumeric Characters

Numbers, codes and letters can be entered in combinations of the alphanumeric keys and the SHIFT key.

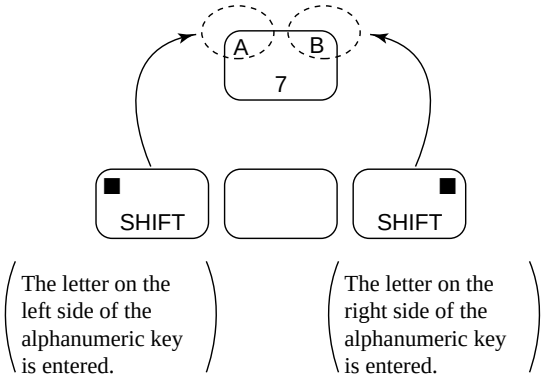
- **Entry of numbers, codes and a space (0 to 9, . , -, ␣)**

Entering of them is possible by using the alphanumeric keys.

Example of entry	Key Operation
-4.3	w x – → G H 4 → U V • → Q R 3
1␣ -0.3	M N 1 → Y Z SPACE → w x – → S T 0 → U V • → Q R 3

- **Entry of letters**

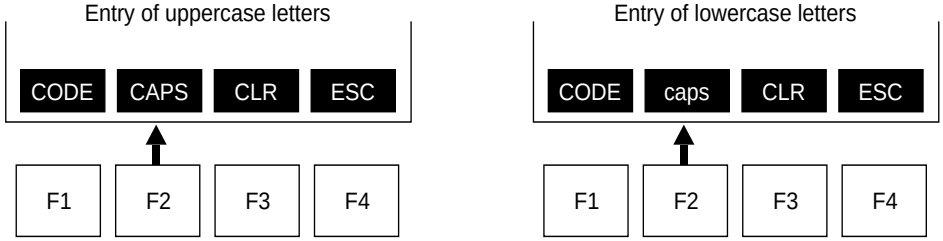
Press an alphanumeric key while one of the SHIFT keys is pressed and the letter on the same side of the key as the shift key that is pressed can be entered. Press the SHIFT key each time when entering a letter.


A
B
7
SHIFT
SHIFT
The letter on the left side of the alphanumeric key is entered.
The letter on the right side of the alphanumeric key is entered.

Example of entry	Key operation
WIC	SHIFT → W X – → SHIFT → I J 5 → SHIFT → C D 8
J.B	SHIFT → I J 5 → U V • → SHIFT → A B 7

- **Selection of uppercase / lowercase of letters**

Uppercase and lowercase letters can be selected alternately by pressing the function key [F2] (CAPS).

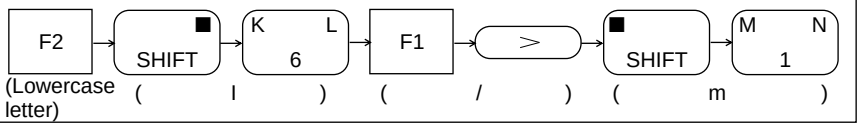


- **Entry of codes**

Codes can be entered by pressing the function key [F1] (CODE). Every time [F1] CODE is pressed, the codes are displayed at the cursor position in the order shown below.

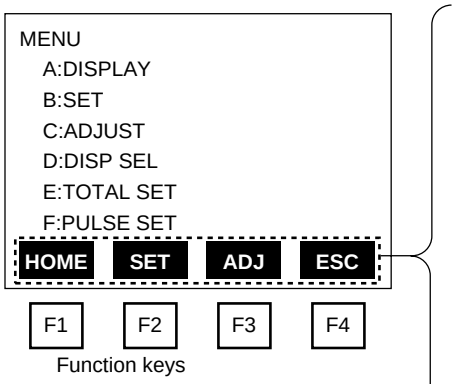
/ . - , + *) (' & % $ # " !

To enter characters after the codes above, move the cursor using the [>] key before entry.

Example of entry	Key operation
I/m	

(2) Function Keys

The functions of the function keys vary with the commands being displayed on the display panel.

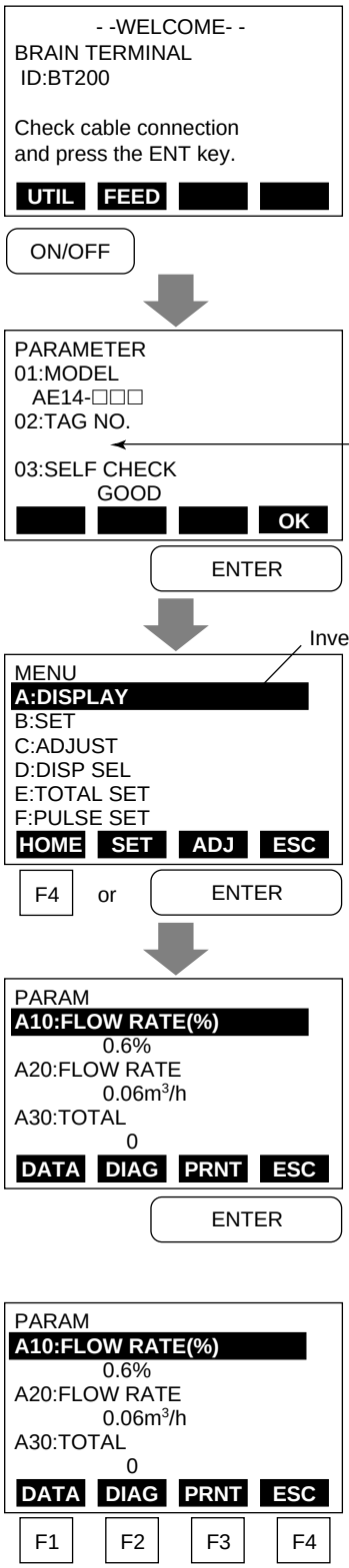


Command	Description
ADJ	Calls up the zero-adjustment menu.
CAPS/caps	Changes the uppercase / lowercase mode.
C LR	Clears entered data /deletes all data.
COPY*	Prints parameters on the screen.
DATA	Updates parameter data.
DEL	Deletes one character.
DIAG	Calls up the self-check screen.
ESC	Returns to the preceding screen.
FEED*	Paper feed.
HOME	Calls up the home menu (A : DISPLAY).
LIST*	Prints all parameters of the menus.
NO	Setting stop / re-setting. Returns to the previous screen
OK	Goes to the next screen.
PARM	Parameter number setting mode.
PON/POFF*	Printer output of data whose setting was changed Mode on / off
PRNT*	Changes to the prints mode.
SET	Calls up the setting menu. (B : SETTING)
SLOT	Returns to the slot selection screen.
GO*	Starts print out.
STOP*	Stops printing.
UTIL	Transfers to the utility screen.

*The command is available only for BT200-P00.

6.1.4 Displaying Flow Rate Data

Flow rate data can be displayed on the BT200 screen according to the following procedure.



Turn the power on and the screen on the left appears after "please wait..." is displayed for a few seconds.

Pressing the ENTER key causes the initial data screen on the left to be displayed.

The tag number specified upon ordering is entered.

Pressing the F4 key or the ENTER key causes the menu screen on the left to be displayed.

- With "A : DISPLAY" displayed on the menu panel in the inverse video bar, press the ENTER key and the flow data screen appears.
- A maximum of three data items can be displayed on one screen.
- Data are communicated at an interval of 5 seconds. Thus, the data are updated every 5 seconds.
- The arrow keys, [∧], [∨] or [<], [>], are used for page feeds or item selection.

Execution of the function keys

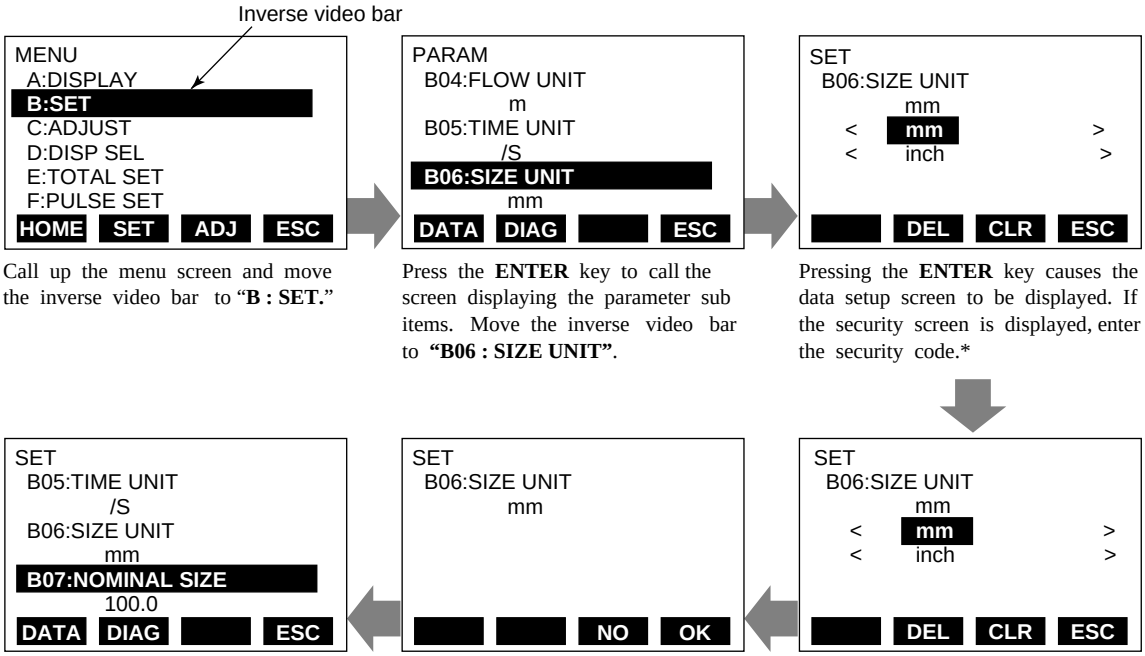
F1: Updates the current data. Pressing this key causes forcible communication with the connected instruments and the data of the instruments are loaded to be read.
F2: Displays the self-check screen.
F3: Displays the parameter print screen.
F4: Returns to the previous panel (menu panel).

6.2 Setting Parameters

NOTE The three parameters must be set to obtain a connect signal. Nominal size, flow span and meter factor must be set.

6.2.1 Setting Nominal Size

Example: flow tube size 50mm



Call up the menu screen and move the inverse video bar to "**B : SET.**"

Press the **ENTER** key to call the screen displaying the parameter sub items. Move the inverse video bar to **"B06 : SIZE UNIT"**.

Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.*

Select "mm" .

Pressing the **ENTER** key causes the data display to blink. After confirming it, press the **ENTER** key once more and the above screen appears. If the data are correct, press the **F4** key.

The screen displaying the parameter sub-items is displayed again. Feed the page using the arrow key and move the inverse video bar to the item **"B07 : NOMINAL SIZE"**

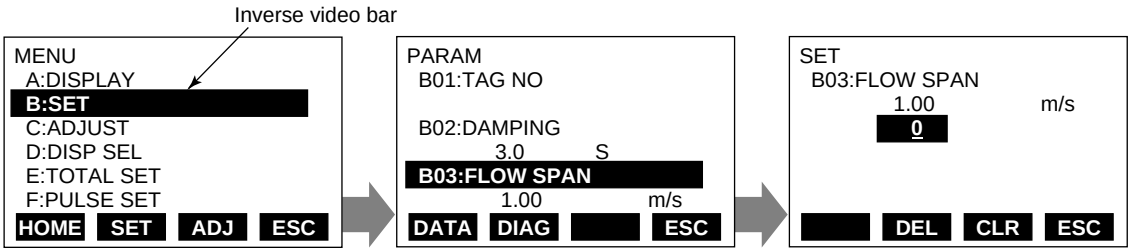
Enter "50.0" using the alphanumeric keys.

Press the **ENTER** key twice and the above screen appears. Check that the data are correct, and press the **F4** key.

Setting is completed. The screen returns to the preceding screen when the **F4** (ESC) key is pressed.

6.2.2 Setting Flow Span Via the BT200

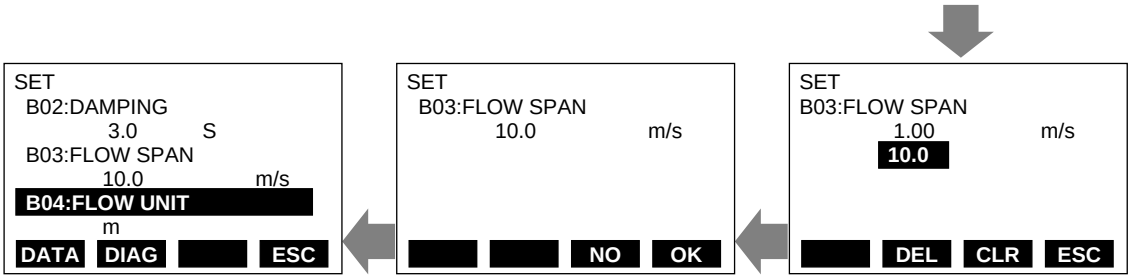
Example: Flow span 10.00 m^3/h



Call up the menu screen and move the inverse video bar to "**B : SET.**"

Press the **ENTER** key to call the screen displaying the parameter sub items. Move the inverse video bar to **"B03 : FLOW SPAN"**.

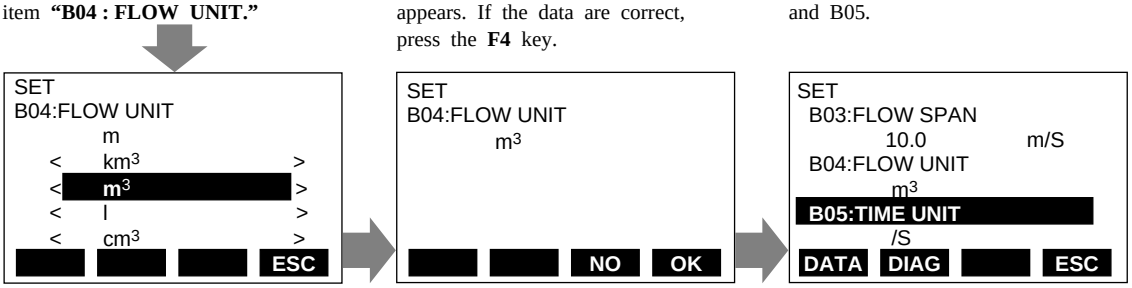
Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.*



Enter "10.0" using the alphanumeric keys. (Enter 1**0.0** only for the sub item **"B03 : FLOW SPAN"**.) The unit, m^3/h is selected at items B04 and B05.

Pressing the **ENTER** key causes the data display to blink. After confirming it, press the **ENTER** key once more and the above screen appears. If the data are correct, press the **F4** key.

The screen displaying the parameter sub-items is displayed again. Feed the page using the arrow key and move the inverse video bar to the item **"B04 : FLOW UNIT."**

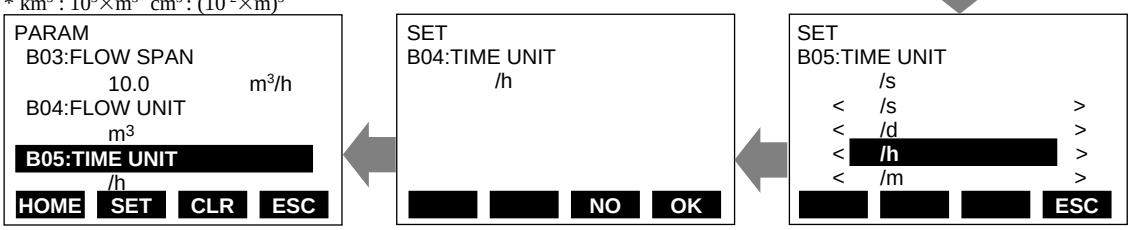


Pressing the **ENTER** key causes the data setup screen to be displayed. Move the inverse video bar to **"m^3."** If the security screen appears, enter the security code* to display the above screen.

* $km^3 : 10^3 \times m^3$ $cm^3 : (10^{-2} \times m)^3$

Press the **ENTER** key twice in succession and the above screen appears. Check that the data are correct, and press the **F4** key.

The screen displaying the parameter sub-items appears again. Feed the page using the arrow key and move the inverse video bar to **"B05 : TIME UNIT"**.



Setting is completed. The screen returns to the preceding screen when the **F4** (ESC) key is pressed.

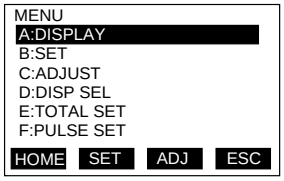
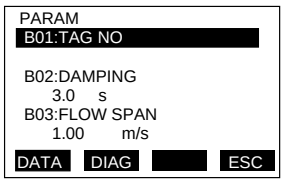
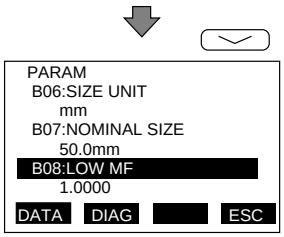
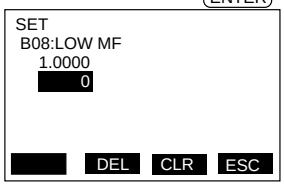
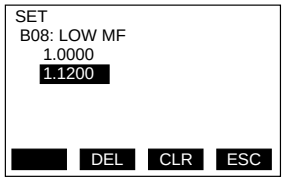
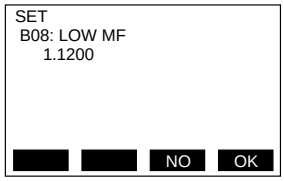
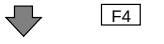
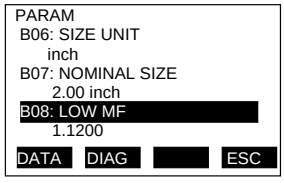
Press the **ENTER** key twice in succession and the above screen appears. Check that the data are correct, and press the **F4** key.

Pressing the **ENTER** key causes the data setup screen to be displayed. Move the inverse video bar to **"/h".**

*For entry of the security code, see IM 1C0A11-01E.

6.2.3 Setting Meter Factor

The meter factors are engraved on the data plate of the combined flow tube.
Example: set " 1.1200" as meter factor(L).

Display	Description
	Call up the menu screen Use the arrow key to select "**B:SET**" with the arrow key and press the **ENTER** key.
	Then, the parameter panel is displayed.
	
	
	Select "**B08:LOW MF**" by feeding the page with the arrow key and press **ENTER** key to call up the following data setup panel.
	Press **ENTER** key on the parameter panel to display the data setup panel as shown on the left. (If the security panel appears, enter the security code.*)
"1.1200"	Set "1.1200" using the alphanumeric keys. Default:1.0000
	
	Press **ENTER** key twice at an interval of a few seconds. The display as shown on the left appears.
	
	If the data is correct, press **F4** key [OK].
	The parameter panel is displayed again. The setting is completed. Set meter factor(H) to parameter No B09. Set in the same way.

* For entry of the security code, see IM1C0A11-01E

6.2.4 Power Frequency

IMPORTANT In case of DC poser supply version, setting power frequency is required.

Display	Description
PARAM **B10:OUTPUT FUNC** PULSE OUT B11:4-20ALM OUT 2.4mA OR LESS B12:POWER FREQ 50.03Hz **DATA DIAG ESC**	Set value in areas where the frequency differs in **"B12 : POWER FREQ".** Default:50.00Hz. Setting Range : 47.00 to 53.00Hz

6.2.5 Pulse Output (Refer to 5.5.1)

Example setting : 10 L output per pulse in a flow rate span of □□□ m^3/h

Display	Description
PARAM **B10:OUTPUT FUNC** PULSE OUT B11:4-20ALM OUT 2.4mA OR LESS B12:POWER FREQ 50.03Hz **DATA DIAG ESC**	The pulse output terminals (P+, P-) are also used for alarms. Select "Pulseoutput" in parameter number "B10".

Code	Content
PULSE OUT	Pulse output
ALARM OUT	Alarm output
BI DIRECTION	Forward / reverse flow measurement
AUTO 2 RANGES	Automatic two range switching
LOW ALARM	Alarm output at low flow limits
TOTAL SWTICH	Totalization switch

Select the volume unit for the pulse weight in parameter number "B04".

Code	Volume unit
n UNIT/P	Volume unit in that for the flow rate span × 10^{-9}
m UNIT/P	Volume unit in that for the flow rate span × 10^{-6}
m UNIT/P	Volume unit in that for the flow rate span × 10^{-3}
UNIT/P	Volume unit in that for the flow rate span × 1
k UNIT/P	Volume unit in that for the flow rate span × 10^{3}
M UNIT/P	Volume unit in that for the flow rate span × 10^{6}
P ULSE/s	Number of pulses output per second at 100% of output

Example) When pulses are tobe output per same liter with the flow rate span of □□ m^3/h, select "m UNIT/P" since a L(liter) = $10^{-3} \times m^3$

Set the pulse weight "10 (L)" in parameter number "F02".

*Since parameter number "F02" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when seting are made. (The decimal point can be moved if required.)

PARAM
F01:PULSE UNIT
m UNIT/P
F02:PULSE SCALE
10 m UNIT/P
F03:PULSE LOWCUT
3. %
DATA DIAG ESC

Set the low cut range percentage in parameter "F03".
Range of setting : (0 to 100% of span)

PALAM
F02:PULSE UNIT
10 m UNIT/P
F03:PULSE LOWCUT
3. %
F04:PULSE WIDTH
50% DUTY
DATA DIAG ESC

Select the pulse width in parameter number "F04"

Code	Pulse width
50%DUTY	(Max. of 1000P/s Min. 0.0001P/s)
0.5ms	(Max. of 1000P/s Min. 0.0001P/s)
1ms	(Max. of 500P/s Min. 0.0001P/s)
20ms	(Max. of 25P/s Min. 0.0001P/s)
33ms	(Max. of 15P/s Min. 0.0001P/s)
50ms	(Max. of 10P/s Min. 0.0001P/s)
100ms	(Max. of 5P/s Min. 0.0001P/s)

Normally, these are all required settings.
The following settings are made depending on the application that is used.

PARAM
N01:TOTAL/PULSE
DAMP
N02:OUTPUT MODE
ON
N03:RATE LIMIT
5. %
DATA DIAG ESC

Select instantaneous flow rate or flow rate after damping data for the pulse output.
(The damping time value is the value set in "B02")
Default : DAMP

Set parameter "N02" to "OFF" when the pulse output transistor is to be off active.

* The "N" item can be opened by entering "55" in parameter number "L02".

6.2.6 Display of Internal Totalization Values (Refer to 5.5.2)

Example : 10 L output per pulse in a flow rate span of □□□ m^3/h

Display

PARAM
E01:TOTAL UNIT
m UNIT/P
E02:TOTAL SCALE
10 m UNIT/P
E03:TOTAL LOWCUT
3. %
DATA DIAG ESC

PARAM
N01:TOTAL/PULSE
DAMP
N02:OUTPUT MODE
ON
N03:RATE LIMIT
5. %
DATA DIAG ESC

Description

Select the volume unit for the pulse weight in parameter number "E01."

Code	Volume unit
n UNIT/P	Volume unit used in that for the flow rate span × 10^{-9}
μ UNIT/P	Volume unit used in that for the flow rate span × 10^{-6}
m UNIT/P	Volume unit used in that for the flow rate span × 10^{-3}
UNIT/P	Volume unit used in that for the flow rate span × 1
k UNIT/P	Volume unit used in that for the flow rate span × 10^{3}
M UNIT/P	Volume unit used in that for the flow rate span × 10^{6}
PULSE/s	Number of pulse output per second at 100% of output

Example) When pulses are to be output per same liter with the flow rate span of □□m^3/h, select "m UNIT/P" since a L(liter) = $10^{-3} \times m^3$

Set the pulse weight "10(L)" in parameter number "E02."

Set the low cut range percentage in parameter "E03."
Range of setting : (0 to 100% of span)

Select instantaneous flow rate or flow rate after damping for the pulse output.
(The damping time value is the value set in "B02."
Default : DAMP (damped flow rate data)

* The "N" item can be opend by entering "55" in parameter number "L02".

6.2.7 Resetting for Totalization Display (Refer to 5.5.3)

Display

PARAM
E04:TOTAL SET
ENABLE
E05:TL SET VALUE
0
E10:TOTAL SWITCH
0
DATA DIAG ESC

PARAM
A10:FLOW RATE(%)
50 .0 %
A20:FLOW RATE
50 .0 m^3/h
A30:TOTAL
12345
DATA DIAG PRNT ESC

SETTING
A30:TOTAL
0
CLR ESC
ENTER

Description

Select totalization enable in parameter number "E04."

Code	Description
ENABLE	Totalization presetting enabled
INHIBIT	Totalization presetting inhibit

Set the totalization preset value in parameter number "E05."
The default is 0 and if the setting is omitted, the parameter functions reset to 0.

If the ENT key is pressed twice while "A30 : TOTAL" is displayed on the setting screen, the totalization value (A30 : TOTAL) will be replaced with the values set in "E05."

6.2.8 Damping Time Constant (Refer to 5.5.4)

Display	Description
PARAM B01:TAG NO B02:DAMPING 3.0 s B03:FLOW SPAN 1.00 m/s DATA DIAG ESC	Set the value in parameter number "B02." Setting Range : 0.1 to 200.0 seconds.

6.2.9 Current Output during Alarm Occurrence (Refer to 5.5.5)

Display	Description
PARAM B10:OUTPUT FUNC PULSE OUT B11:4-20 ALM OUT 2.4mA OR LESS B12:POWER FREQ 50.03Hz DATA DIAG ESC	Set the value for current output to be used during alarms in parameter "B11." (Default : 2.4 mA or less)

Code	Content
2.4mA OR LESS	2.4 mA or less
4.0mA	4.0 mA
HOLD	Fixed to output when alarm is generated.
21.6mA OR MORE	21.6 mA or more

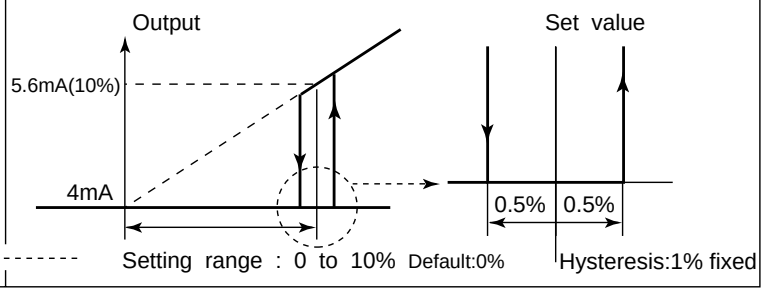
6.2.10 Reversing Flow Direction(Refer to 5.5.6)

Display	Description
PARAM B13:VELOCITY CHK 5 m/s B14:FLOW DIR REVERSE B60:SELF CHECK GOOD m/s DATA DIAG ESC	The flow direction can be set in parameter number "B14"

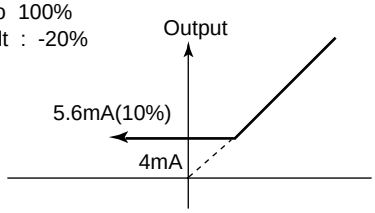
Code	Description
FORWARD	Forward direction
REVERSE	Reverse direction to flow arrow

6.2.11 Limiting Current Output (Refer to 5.5.7)

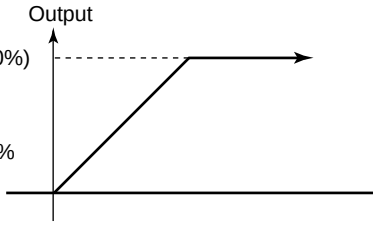
(1) 4 to 20 mA low cut output (Current Output near by 0% Range)

Display	Description
PARAM G01:4-20 LOW CUT 10 % G02:4-20 LOW LMT -20 % G03:4-20 H LMT 120 % DATA DIAG ESC	

(2) 4 to 20 mA Low Limit

Display	Description
PARAM G01:4-20 LOW CUT 0 % **G02:4-20 LOW LMT** 10 % G03:4-20 H LMT 110 % DATA DIAG ESC	Setting Range : -20 to 100% Default : -20% 

(3) 4 to 20 mA High Limit

Display	Description
PARAM G01:4-20 LOW CUT 0 % G02:4-20 LOW LMT -20 % **G03:4-20 H LMT** 90 % DATA DIAG ESC	 Setting range : 0 to 120% Default : 120%

6.2.12 Forward and Reverse Flow Measurement (Refer to 5.5.8)

Display

PARAM
B09:HIGH MF
1.0000
B10:OUTPUT FUNC
BI DIRECTION
B11:4-20 ALM OUT
2.4mA OR LESS
DATA DIAG ESC

Description

Select "BI DIRECTION" (Direct / reverse flow measuring mode) in parameter number "B10".

Code	Content
PULSE OUT	Pulse output
ALARM OUT	Alarm output
BI DIRECTION	Forward / reverse flow measurement
AUTO 2 RANGES	Automatic two range switching
LOW ALARM	Alarm output at low flow limits
TOTAL SWTICH	Totalization switch

Display

PARAM
B30 :REV. SPAN
□□□
B31 :BI. DIREC HYS
□□
B33 :FOR. SPAN2
□□□
DATA DIAG ESC

Description

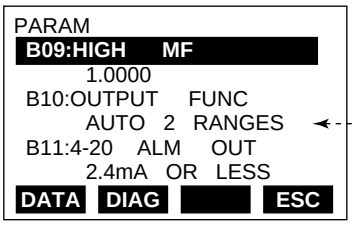
Reverse direction span can be set in parameter No."B30".
Flow rate unit is the same as forward direction span.

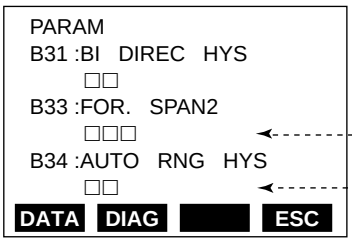
Further reverse range span should be set in the same number of places of decimals as forward range span.
Example: forward flow rate : 1.000 then reverse flow rate should be 4.000.

Hysteresis width at switching direction can be set in parameter No."B31".
It is the rate(%) of the smaller span, either forward or reverse span.

6.2.13 Automatic Two Range Switching (Refer to 5.5.9)

Display





Description

Select "AUTO 2 RANGES" (Automatic two range transfer) in parameter number "B10".

Code	Content
PULSE OUT	Pulse output
ALARM OUT	Alarm output
BI DIRECTION	Forward / reverse flow measurement
AUTO 2 RANGES	Automatic two range switching
LOW ALARM	Alarm output at low flow limits
TOTAL SWTICH	Totalization switch

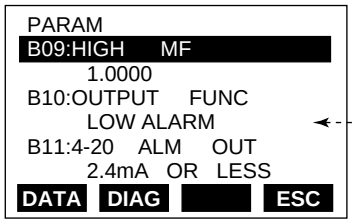
Forward second range can be set by calling up parameter No. "**B33**".
Setting restrictions: First range ≤ 2nd range.

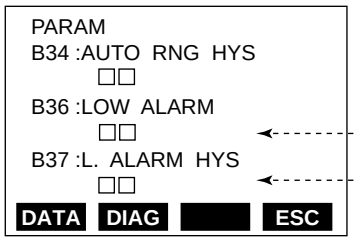
Further second range span should be set in the same number of places of decimals as first range span in parameter No. "**B03**".
Example: First range : 1.000 then second range should be
4.000

Hysteresis width at switching range can be set in parameter No. "**B34**".
It is the rate (%) of first range span.

6.2.14 Alarm Output at Low Flow Limits (Flow Switch) (Refer to 5.5.10)

Display





Description

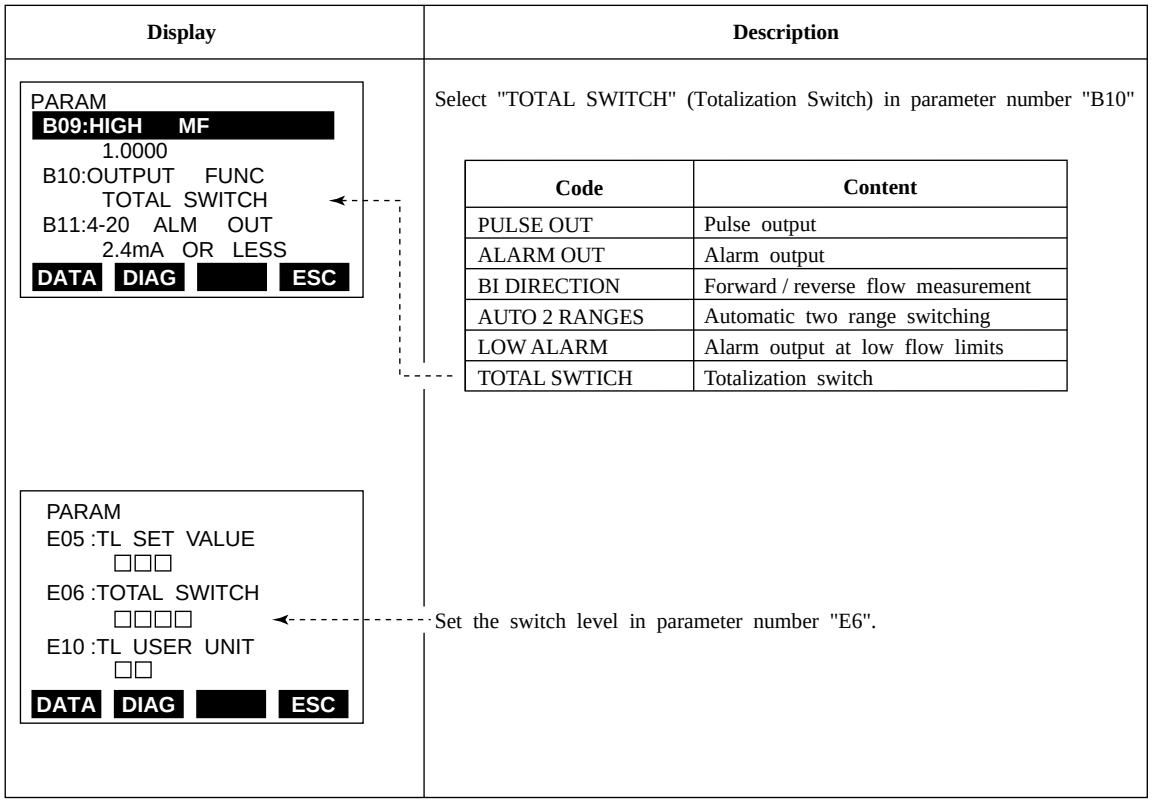
Select "LOW ALARM" (Alarm output at low flow limits) in parameter number "B10" .

Code	Content
PULSE OUT	Pulse output
ALARM OUT	Alarm output
BI DIRECTION	Direct / reverse flow measurement
AUTO 2 RANGES	Automatic two range transfer
LOW ALARM	Alarm output at low flow limits
TOTAL SWTICH	Totalization switch

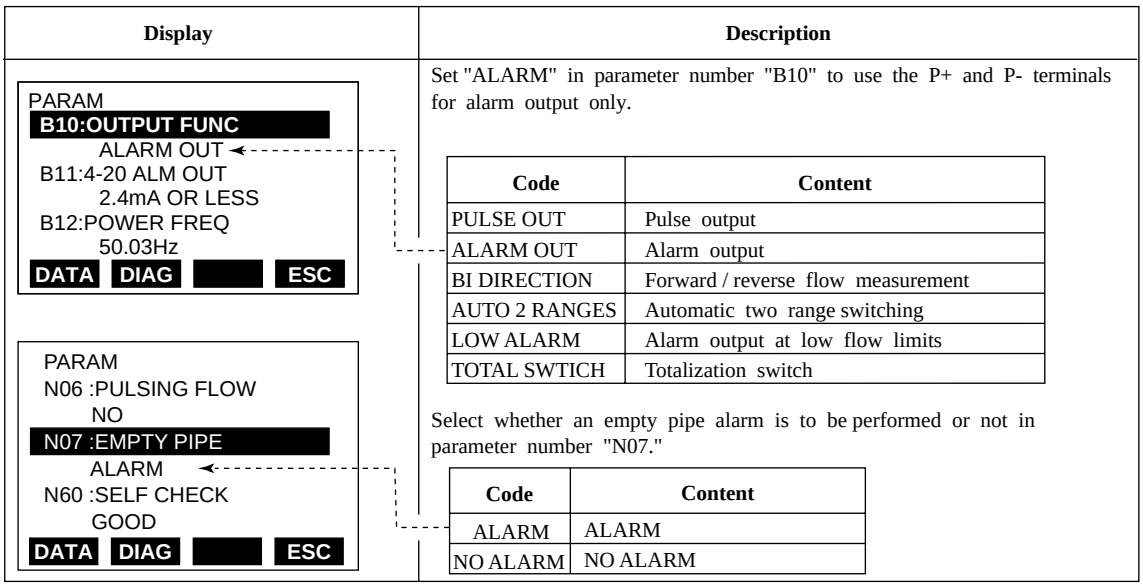
Set the comparison level in parameter number "B36" .

Set the hysteresis in parameter "B37" .

6.2.15 Totalization Switch Output (Refer to 5.5.11)



6.2.16 Alarm Output (Refer to 5.5.12)



* The "N" item can be opend by entering "55" in parameter number "L02".

6.2.17 Data Setting Enable / Inhibit (Refer to 5.5.13)

- This function makes it possible to inhibit all data changes (except L1). However, automatic zero adjustment can be made if the automatic zero-adjustment function is enabled (set in C1). Also, totalization presetting can be done if the totalization presetting function is enabled (set in E4).

Display	Description
PARAM **L01:TUNING** INHIBIT ← L02:KEY 00 L60:SELF CHECK GOOD **DATA DIAG ESC**	Selecting "INHIBIT" in parameter number "L01" disables data setting.

Code	Content	
ENABLE	Data setting enabled.	← Default
INHIBIT	Data setting inhibit.	

6.2.18 Procedure of Selecting Special Application Items (Refer to 5.5.14)

Display	Description
PARAM L01:TUNING INHIBIT **L02:KEY** 55 ← L60:SELF CHECK GOOD **DATA DIAG ESC**	It is possible to open up to item N when "55" is entered in parameter number "L02."

Code	Content	
00	Accessible up to L parameters	← Default
55	Accessible up to N parameters	

6.2.19 Rate Limit (Refer to 5.5.15)

Display	Description
PARAM N03:RATE LIMIT 5 % ← N04:DEAD TIME 0 s ← N05:POWER SYNCH YES **DATA DIAG ESC**	Set the rate limit value in parameter number "N03." Range of possible settings : 0 to 10%. Set the dead time in parameter number "N04." Range of possible settings : 0 to 15 seconds. Default : 0 (Rate limit function off)

6.2.20 Pulsating Flow (Refer to 5.5.16)

Display	Description
PARAM N04:DEAD TIME 0 N05:POWER SYNCH YES **N06:PULSING FLOW** YES ← **DATA DIAG ESC**	Select "YES" (pulsating flow counteraction) in parameter number "N06". (Default : NO)

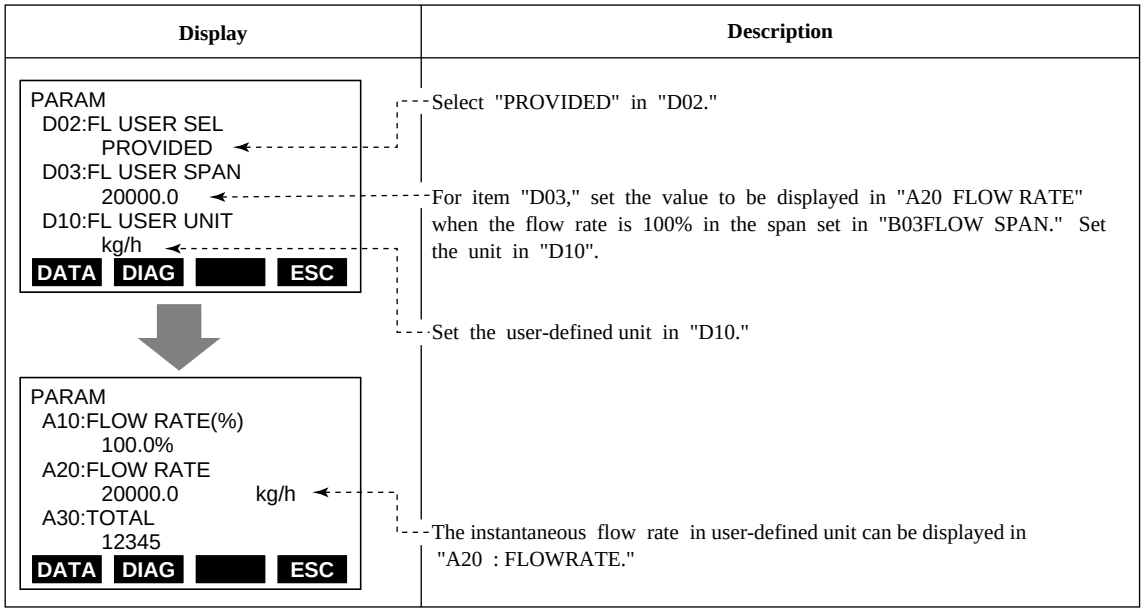
Code	Content
NO	Normal
YES	Counteracting pulsating flow

6.2.21 User-Defined Units Via the BT200

This function displays the instantaneous flow rate indicated in "A20 FLOW RATE" in units other than those selectable with B04. If the specific gravity of the fluid is known, the instantaneous flow rate can be displayed in weight units.

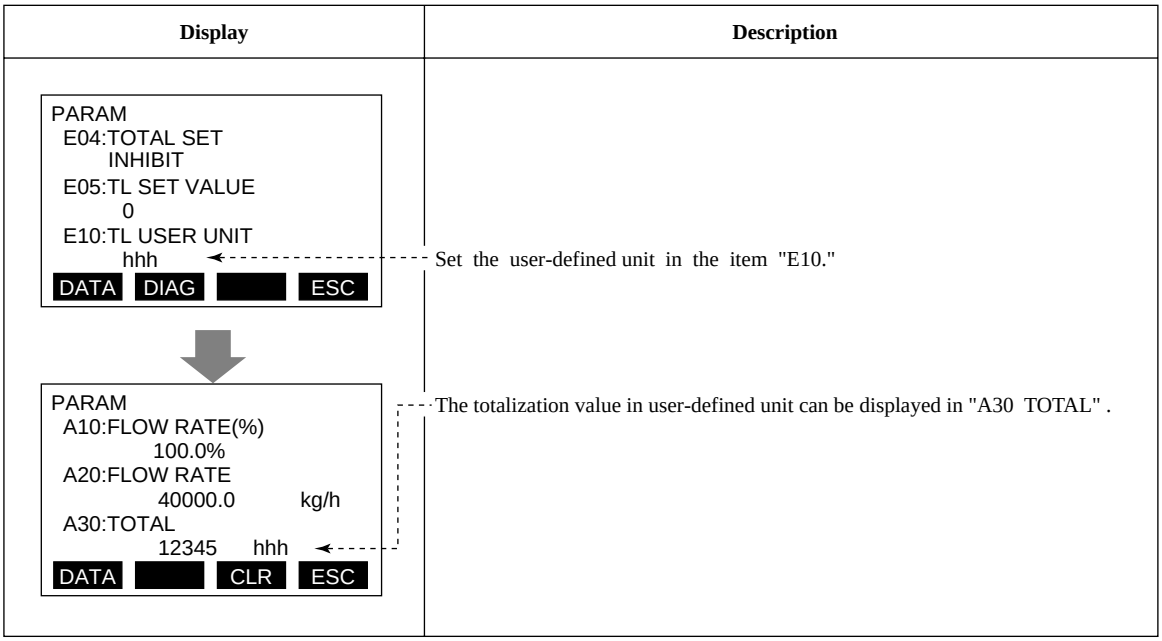
(1) User-Defined units for Instantaneous Flow Rate

Example : Displaying the flow rate of a fluid (its specific gravity is 2) in weight (kg) in a flow rate span of 10m^3/h. When the flow rate is 100%, 20,000kg is displayed.



(2) User-Defined Units for Totalization Values

User-defined unit can be added to the totalization display in "A30 TOTAL".



6.2.22 Other Important Points to Note

(1) The automatic power-off function turns the terminal off automatically if no key is pressed for about 5 minutes or more. However, this function does not operate when the terminal is displaying the variables in (2) below.

(2) When A10 FLOW RATE (%) or A20 FLOW RATE is displayed, data are updated every 5 seconds.

(3) UPLD is used when the parameters of one ADMAG AE are copied to the BT and DNLD is used when the parameters copied to the BT are copied to another ADMAG AE. (For details, see the "BT200 Instruction Manual " (IM 1C0A11-01E). Parameters that can be copied include span and pulse factor parameters such as the following:

B02 DAMPING, B03 FLOW SPAN, B04 FLOW UNIT, B05 TIME UNIT
B06 SIZE UNIT, B07 NOMINAL SIZE, B10 OUTPUT FUNC, B11 4-20 ALM OUT
D01 DISP SELECT, D02 FL USER SEL, D03 FL USER SPAN, D10 FL USERUNIT, E01 TOTAL UNIT, E02 TOTAL SCALE, E03 TOTAL LOWCUT, E04 TOTAL SET, E05 TL SET VALUE, E10 TL USER UNIT, F01 PULSE SELECT, F02 PULSE SCALE, F03 PULSE LOW CUT, F04 PULSE WIDTH, G01 4-20 LOW CUT
G02 4-20 LPW LMT, G03 4-20 H LMT.

7. ACTUAL OPERATION

After you have installed the flowtube into the process piping, wired the input / output functions, set up the required converter parameters, and performed the pre-operation zero adjustment, the magnetic flowmeter should output an accurate flow signal from its terminals as soon as the measured liquid begins to flow.

This section describes procedures of zero adjustment and alarms countermeaure.

7.1 Pre-Operation Zero Adjustment

In the magnetic flowmeter, zero adjustment is required before beginning operation in order to obtain a 4 to 20mA signal that is accurately proportional to the flow.

This section describes two procedures for performing zero adjust : one using the switches on the converter panel and the other using the BT200. Use either method.

Zero adjustment is made to set the instrument to 0% (4mA) when the flow rate is 0.

The detector must be filled with fluid and let it stand until all motion has ceased.

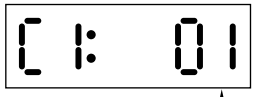
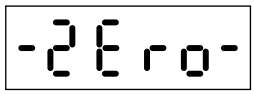
IMPORTANT

- Zero adjustment should be done only when the fluid is filled in the flow tube, and the fluid velocity is complete zero by closing the valve.
- Zero adjustment should be done prior to the other operation. For 30 seconds during the zero adjustment, any setting cannot be accepted.

7.1.1 Zero Adjustment Using Data Setting Keys

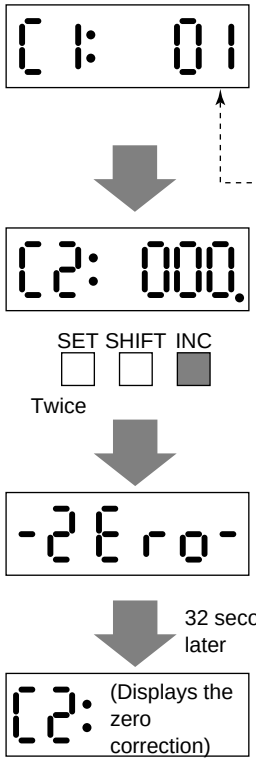
The following two procedures can be used to perform zero adjustment with the data setting keys.

(1) Hold Down the INC Key for Two Seconds in Flow Rate Data Display Mode.

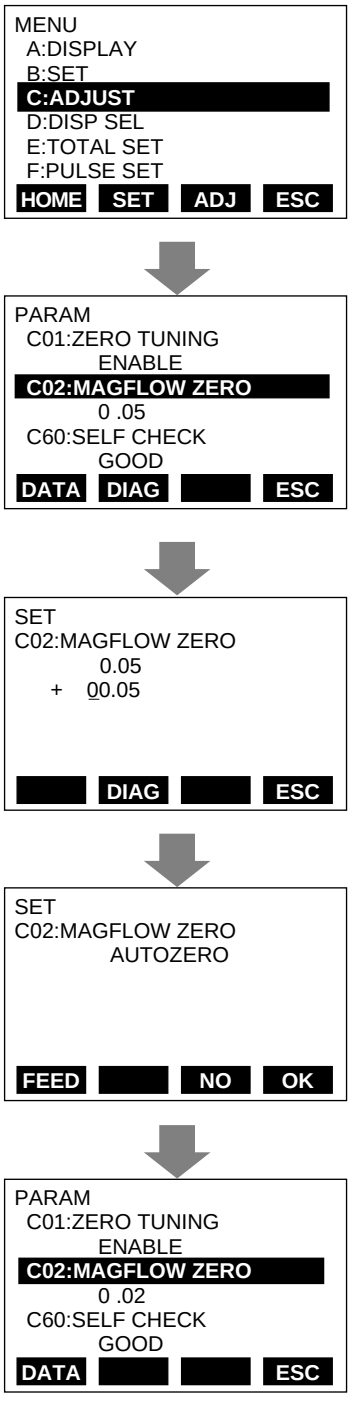
Display	Description
 Default : 01	Call up the setting mode and set "**01**" in "**C1**" (zero adjustment enable / inhibit).
SET SHIFT INC 2 seconds or longer	Hold down the **INC** key for two seconds in flow rate data display mode.
	The display panel shows "**-ZEro-**". After about 30 seconds, the zero correction is displayed. Then the meter returns to data display mode.

Code	Content
00	INHIBIT
01	ENABLE

(2) Display “C2” and Press the SET Key Twice.

Display	Description
	Call up the setting mode and set "**01**" in "**C1**" (zero adjustment enable/inhibit). **Code** / **Content** 00 INHIBIT 01 ENABLE Call up "**C2**" and press the SET key twice (as for data entry). The display panel shows "**-ZEro-**". After about 32 seconds, the zero correction is displayed. Then the meter returns to data display mode.

7.1.2 Zero Adjustment Via the BT200

Display	Description
	Call up the menu screen and select "**C:ADJUST**" Press the **ENTER** key to call the screen displaying the parameter sub items. Select **C02:MAGFLOW ZERO** Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.* While "**C02:MAGFLOW ZERO**" is displayed, press the **ENTER** key once, then wait a few seconds and press again. "**AUTO ZERO**" is now displayed After about 30 seconds, press the "**F4**" of the Function key causes the Menu screen to be displayed. The zero correction is displayed. Then the meter returns to data display mode.

*For entry of the security code,see IM IC0A11-0IE

7.2 Self-check Functions

- The self-check function displays instrument internal errors, input/output signal abnormalities, setting errors, and other problems.
- When an alarm occurs, an alarm number announcing that an error has occurred is superimposed on the normal data display.
  However, alarms are only displayed during normal flow rate data display mode and when parameter numbers are changed in the setting mode. (Alarms are not displayed when data items are being changed.)
- When the BT200 is used, alarms are displayed in the A60 to N60 SELF CHECK parameter.

7.2.1 Display and Output Status when Alarm is Present

- If an error occurs, the panel display LED flashes and an alarm number is superimposed on the normal display.
  During this time the current output is fixed to 2.4mA or less., 4mA, HOLD or 21.6mA or more, as selected in 4-20 ALM OUT (out-put current during alarm).
- An alarm (status contact output) is output for any of the errors indicated in the table at right.

Display		LED	Contact output	Current output	Totaliza-tion pulse
AE	Display on BT				
00	GOOD	OFF	ON	Normally	Normally
01	ERROR	Flash-ing	OFF	Fixed (See note.)	Stops
02	μ P FAULT				
03	EEPROM FAULT				
04	A/D(H) FAULT				
05	A/D(L) FAULT				
06	SIGNAL OVERFLOW				
07	COIL OPEN				
08	VEL. SAPN>10m/s				
09	VEL. SPAN<0.3m/s				
10	P.SPAN>1000p/s				
11	P.SPAN>500m/s				
12	P.SPAN>25p/s				
13	P.SPAN>15p/s				
14	P.SPAN>10p/s				
15	P.SPAN>5p/s				
16	P.SPAN<0.0001p/s				
17	T.SPAN>1000p/s				
18	T.SPAN<0.0001p/s				
19	4-20 LMT ERROR				
20	EMPTY PIPE				
21	MULTI RANGE ERROR				

Note : As selected in 4-20 ALM OUT (output current during alarm)

7.2.2 Error Description and Countermeasures

AE	Display on BT	Error Contents	Countermeasures
02	µP FAULT	Microprocessor error	Contact the nearest Yokogawa office, or service center
03	EEPROM FAULT	EEPROM error	
04	A/D(H) FAULT	A/D converter (high frequency side) error	
05	A/D(L) FAULT	A/D converter (low frequency side) error	
06	SIGNAL OVERFLOW	Excessive input signal	Check for the following : ● Mixup of the signal, power supply, execution, and other cable. ● Stray electorical currents in the measured liquid. ● Improper grouping
07	COIL OPEN	Flow Tube coil open-circuit	Contact the nearest Yokogawa office, or service center
08	VEL. SAPN>10m/s	Setting for span flow velocity exceeds 11 m/s	Change setting
09	VEL. SAPN<0.3m/s	Setting for span flow velocity is 0.2 m/s or below	
10	P.SPAN>1000p/s	Pulse output rate exceeds 1100 p/s, at 50% DUTY Pulse output rate exceeds 1000 p/s, at 0.5 ms pulse width	
11	P.SPAN>500p/s	Pulse output rate exceeds 500 p/s at 1 ms pulse width	
12	P.SPAN>25p/s	Pulse output rate exceeds 25 p/s at 20 ms pulse width	
13	P.SPAN>15p/s	Pulse output rate exceeds 15 p/s at 33 ms pulse width	
14	P.SPAN>10p/s	Pulse output rate exceeds 10 p/s at 50 ms pulse width	
15	P.SPAN>5p/s	Pulse output rate exceeds 5 p/s at 100 ms pulse width	
16	P.SPAN<0.0001p/s	Pulse output rate is 0.00005 p/s or below	
17	T.SPAN>1000p/s	Internal totalization exceeds 1100 p/s	
18	T.SPAN<0.0001p/s	Internal totalization at 0.00005 p/s or less	
19	4-20 LMT ERROR	Analog low limit > Analog high limit	
20	EMPTY PIPE	Pipe is not filled with fluid or insulating material attached to electrode.	Fill the flow tube with fluid or clean the flow tube inside.
21	MULTI RANGE ERROR	In Auto 2 range, 1st range > 2nd range	Change Setting

8. MAINTENANCE

8.1 Loop Test (Test output)

This function enables you to set up any desired value, and to output it from the converter. Since this function corresponds to flow rate totalization display and pulse output, this makes it possible to check operation of individual functions.

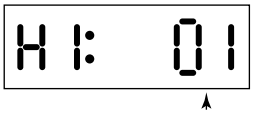
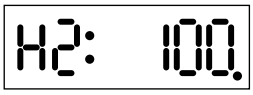
The test functions of status outputs are also provided.

IMPORTANT

- Test outputs take priority of the flow signal.
  Do not forget to return to the normal operation mode after the loop test.
- In case "BI DIRECTION" is set at OUTPUT FUNCTION (Parameter No. b10), the setting range is available -108 to +108. Please set the loop test value in +/- percentage based on the larger flow span within forward and reverse flow span.
- In case "AUTO 2 RANGES" is set at OUTPUT FUNCTION (Parameter No. b10), the loop test setting value should be set in percentage based on the second range.

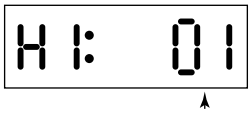
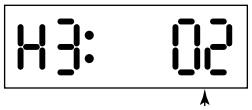
8.1.1 Setting for Test Output Using Data Setting Keys

(1) Current Output (Corresponding to Flow Rate, Pulse and Totalization Display)

Display	Description
	Call up the setting mode and display "H1" (test mode) and set "01"
	Code / **Content**: 00 Normal operation; 01 Test output
 Setting range : -10 to 110%	Display "H2" and set the value in % of maximum span. (The figure shows a 100% setting.)

* These functions must be returned to their original status during flow rate measurements.

(2) Status Output

Display	Decription
	Call up the setting mode and display "H1" (test mode) and set "01".
	Code / **Content**: 00 Normal operation; 01 Test output
	Select the mode of status to be output in "H3".
	Code / **Content**: 00 Normal operation; 01 Transistor contact (ON); 02 Transistor contact (OFF)

* These functions must be returned to their original status during flow rate measurements.

8.1.2 Setting for Test Output Via the BT200

(1) Current Output (Corresponding to Flow Rate, Pulse and Totalization Display)

Display	Description
PARAM H01:TEST MODE TEST H02:OUTPUT VALUE 100 % H03:STATUS OUT NORMAL DATA DIAG ESC	Select Test mode in parameter number "**H01**" **Code** / **Description** NORMAL — Normal operation TEST — Test output Display "**H02:OUTPUT VALUE**" and set the value in % of maximum span. (The figure shows a 100% setting.)

* These functions must be returned to their original status during flow rate measurements.

(2) Status Output

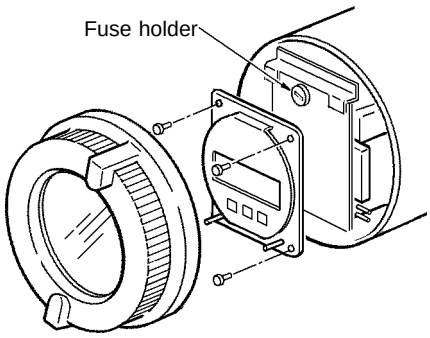
Display	Description
PARAM H01:TEST MODE TEST H02:OUTPUT VALUE 100 % H03:STATUS OUT NORMAL DATA DIAG ESC	Call up the setting mode and display "**H1**" (test mode) and set "**01**". **Code** / **Content** NORMAL — Normal operation TEST — Test output Select the mode of status to be output in "**H03**". **Code** / **Content** NORMAL — Normal operation CLOSED(ON) — Trarsistor contact (ON) OPEN(OFF) — Trarsistor contact (OFF)

* These functions must be returned to their original status during flow rate measurements.

8.2 Fuse Replacement

WARNING This instrument must be installed by expart engineer or skilled personnel. Fuse replacement is not permitted for operators.

The fuse holder is located under the display which has to be removed to allow fuse replacement. A spare fuse is taped to the cover of the converter.



CAUTION

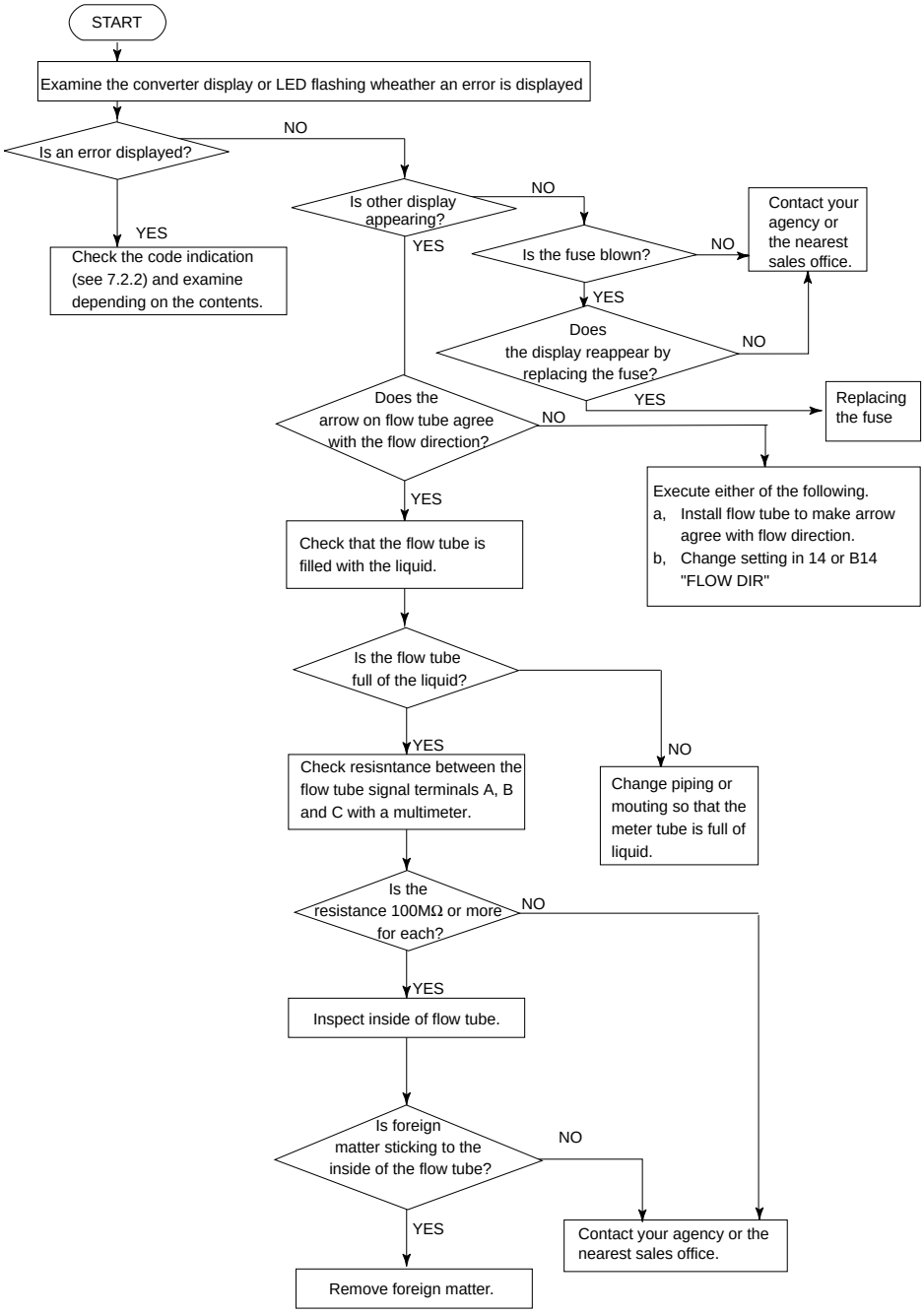
Before replacing the fuse, make sure to turn OFF the power supply and disconnect the power surce. Use only specified fuses which should be obtained from your nearest Sales & service Office. The use of other fuses might cause fire.

After replacing the fuse, confirm that the connector of the display board has not loosened.

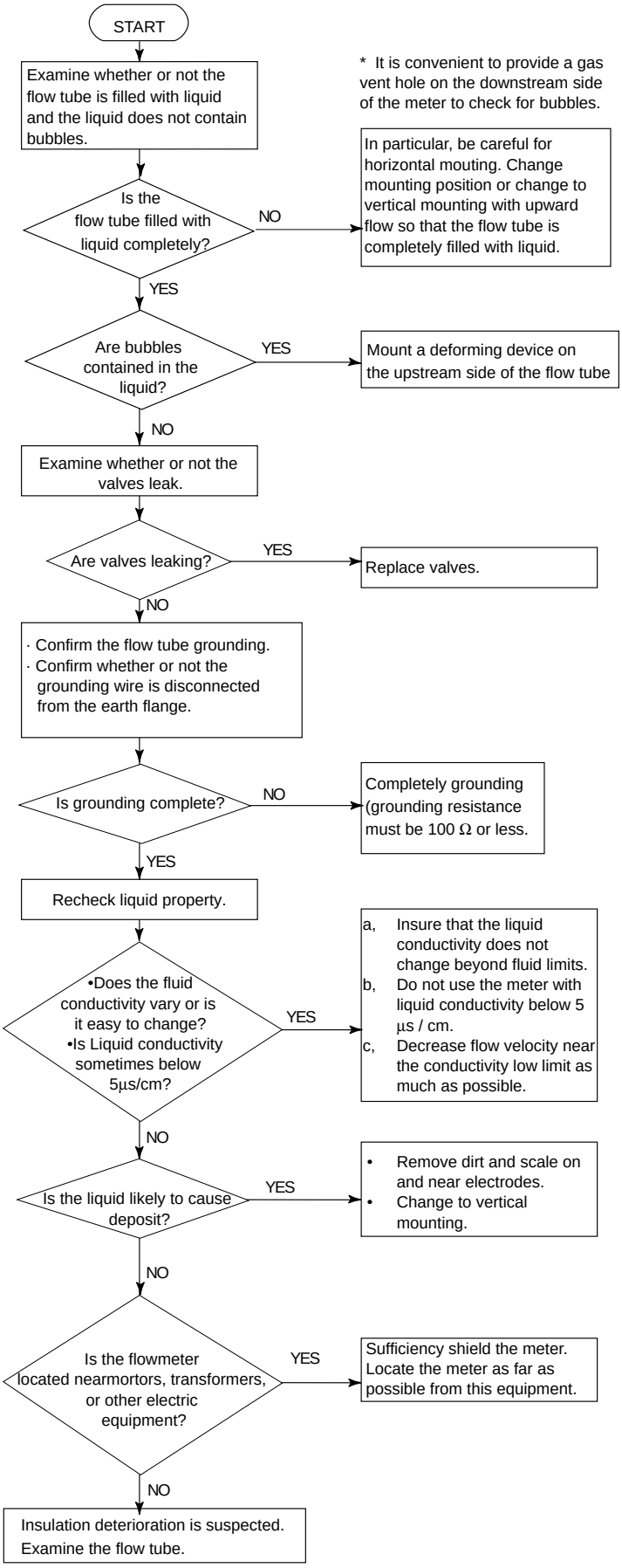
8.3 Trouble Shooting

Although magnetic flowmeters rarely require maintenance, failures occur when the instrument is not operating correctly. Since a failure is located by troubleshooting the receiving instrument information. This information will be described below.

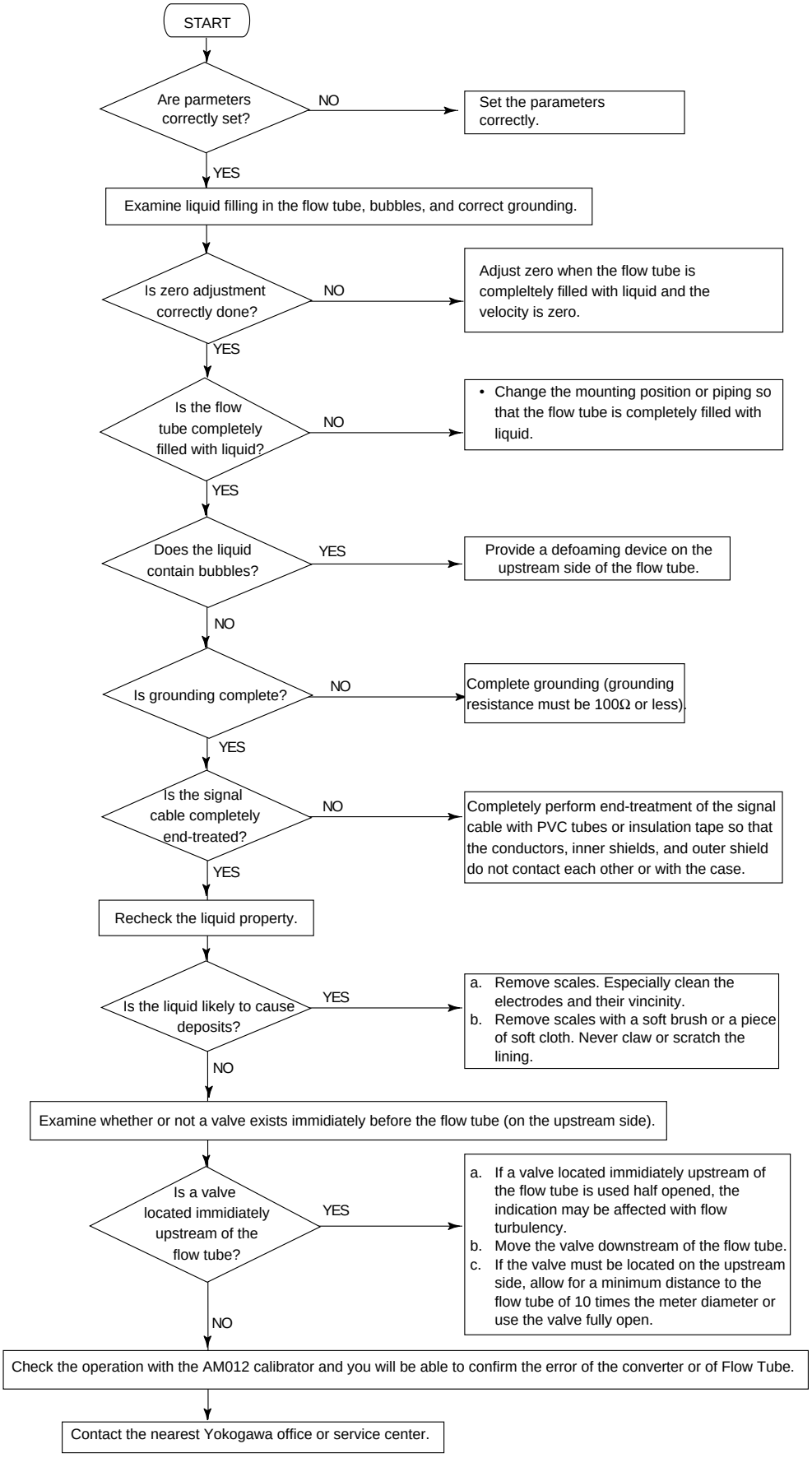
(1) No Indication


START
Examine the converter display or LED flashing wheather an error is displayed
Is an error displayed?
NO
YES
Check the code indication (see 7.2.2) and examine depending on the contents.
Is other display appearing?
NO
YES
Is the fuse blown?
NO
Contact your agency or the nearest sales office.
YES
Does the display reappear by replacing the fuse?
NO
YES
Replacing the fuse
Does the arrow on flow tube agree with the flow direction?
NO
YES
Execute either of the following.
a, Install flow tube to make arrow agree with flow direction.
b, Change setting in 14 or B14 "FLOW DIR"
Check that the flow tube is filled with the liquid.
Is the flow tube full of the liquid?
YES
NO
Check resisntance between the flow tube signal terminals A, B and C with a multimeter.
Change piping or mouting so that the meter tube is full of liquid.
Is the resistance 100MΩ or more for each?
NO
YES
Inspect inside of flow tube.
Is foreign matter sticking to the inside of the flow tube?
NO
YES
Contact your agency or the nearest sales office.
Remove foreign matter.

(2) Unstable Zero


START
Examine whether or not the flow tube is filled with liquid and the liquid does not contain bubbles.
* It is convenient to provide a gas vent hole on the downstream side of the meter to check for bubbles.
Is the flow tube filled with liquid completely?
NO
In particular, be careful for horizontal mouting. Change mounting position or change to vertical mounting with upward flow so that the flow tube is completely filled with liquid.
YES
Are bubbles contained in the liquid?
YES
Mount a deforming device on the upstream side of the flow tube
NO
Examine whether or not the valves leak.
Are valves leaking?
YES
Replace valves.
NO
· Confirm the flow tube grounding.
· Confirm whether or not the grounding wire is disconnected from the earth flange.
Is grounding complete?
NO
Completely grounding (grounding resistance must be 100 Ω or less.
YES
Recheck liquid property.
•Does the fluid conductivity vary or is it easy to change?
•Is Liquid conductivity sometimes below 5µs/cm?
YES
a, Insure that the liquid conductivity does not change beyond fluid limits.
b, Do not use the meter with liquid conductivity below 5 µs / cm.
c, Decrease flow velocity near the conductivity low limit as much as possible.
NO
Is the liquid likely to cause deposit?
YES
• Remove dirt and scale on and near electrodes.
• Change to vertical mounting.
NO
Is the flowmeter located nearmortors, transformers, or other electric equipment?
YES
Sufficiency shield the meter. Locate the meter as far as possible from this equipment.
NO
Insulation deterioration is suspected. Examine the flow tube.

(3) Disagreement of Indication with Actual Flow Result


START
Are parmeters correctly set?
NO
Set the parameters correctly.
YES
Examine liquid filling in the flow tube, bubbles, and correct grounding.
Is zero adjustment correctly done?
NO
Adjust zero when the flow tube is compleltely filled with liquid and the velocity is zero.
YES
Is the flow tube completely filled with liquid?
NO
• Change the mounting position or piping so that the flow tube is completely filled with liquid.
YES
Does the liquid contain bubbles?
YES
Provide a defoaming device on the upstream side of the flow tube.
NO
Is grounding complete?
NO
Complete grounding (grounding resistance must be 100Ω or less).
YES
Is the signal cable completely end-treated?
NO
Completely perform end-treatment of the signal cable with PVC tubes or insulation tape so that the conductors, inner shields, and outer shield do not contact each other or with the case.
YES
Recheck the liquid property.
Is the liquid likely to cause deposits?
YES
a. Remove scales. Especially clean the electrodes and their vincinity.
b. Remove scales with a soft brush or a piece of soft cloth. Never claw or scratch the lining.
NO
Examine whether or not a valve exists immidiately before the flow tube (on the upstream side).
Is a valve located immidiately upstream of the flow tube?
YES
a. If a valve located immidiately upstream of the flow tube is used half opened, the indication may be affected with flow turbulency.
b. Move the valve downstream of the flow tube.
c. If the valve must be located on the upstream side, allow for a minimum distance to the flow tube of 10 times the meter diameter or use the valve fully open.
NO
Check the operation with the AM012 calibrator and you will be able to confirm the error of the converter or of Flow Tube.
Contact the nearest Yokogawa office or service center.